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MAR 8 1924

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG'D. TRADE MARK GREAT BRITAIN. No. 410426 REG. U. S. PAT. OFF.

Prosperity Ahead For Farmers—Senator Capper

PAGE 525

Be an Auto and Electrical Expert

McSweeny Trained Men in Demand at $40 to $150 a Week

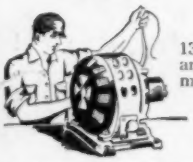
Here's one instance of the success McSweeny Training has brought thousands of men:

George W. Smith, West Alexandria, O., has earned over $800 a month ever since he finished his training. He now owns his own garage and auto agency. When Smith came to me he knew nothing about autos. In eight weeks my methods made a big-money man out of him. And there's no reason why any boy can't do just as well.

I'll Pay Your Railroad Fare to Cincinnati and Board You for My Full 8 Weeks Term

I get calls every day from garages, battery stations, auto factories and so on, for McSweeny-trained men. Albert Boyer, of Alexandria, Ky., is only 19 years old, but has been making a big success in his own business. He says my training made him win out. To fill the calls on me for trained experts, I'm making this wonderful offer for a short time. I'll pay your railroad fare to Cincinnati, and board you for the full eight weeks.

In 50 Days You're Ready to Command a Big Pay Job



13,000,000 Autos and 1,000,000 Tractors must be kept running. Spend 50 days in my great shops and no job will be too hard for you. Big wages and steady work certain. "McSweeny training made me Chief Mechanic of a big plant in three months," writes Fred Pendley, Blowing Rock, N. C.

Electrical Course Included

Every one of my students receives a complete course in practical electricity. He learns ignition, starting, lighting, power plant and generator wiring—all by the same work-shop job-methods which teach him all about carburetors, transmissions, vulcanizing, battery onstruction and repair. He learns in 50 days to tackle any machine, in any condition, and "put it on its feet".

"Mac" Trains Men With Tools—Not Textbooks You Learn Under Experts in a Wonderful Shop

"The Great McSweeny School"

I have successfully managed more auto and tractor schools than any man in the world. Now I am in complete control of the former Rahe Auto & Tractor School, of Cincinnati, Ohio. Now I can put into complete operation many ideas and plans which, I sincerely believe, will make this the greatest Auto, Tractor and Electrical training institution in existence. Write me and I'll tell you what this splendid school can mean to YOU, to your pay envelope and to your future.

Write Today for Free Catalog & Special Reduced Tuition Offer for McSweeny Life Scholarship.

McSWEENY

Auto, Tractor & Electrical

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Successors to Rahe Auto & Tractor School

McSweeny Auto, Tractor & Electrical School
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Send me your Big Free Book on auto and tractor business, and send me information on special reduced tuition offer, in effect for a short time only.

Name .....

Street or R. R. .....

City or Town ..... State .....

(No facilities for colored students)

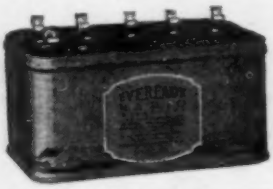
"THE AIR IS FULL OF THINGS YOU SHOULDN'T MISS"

Why Big Cells Count in Radio "B" Batteries

THIS handsome metal case Eveready "B" Battery No. 766 costs only two-thirds more than the smallest Eveready "B" Battery, but it *contains seven times the electricity!* This makes the No. 766 over four times as economical as its baby brother. That is why most people buy it.

Its fifteen large cells give 22½ volts of strong, steady energy day after day. Cells that pour out power the moment you turn on your tubes. Cells that rest well when idle, renewing their vigor for your next demands.

No cells have a bluer-blooded ancestry than these. They are the product of thirty years of dry battery research and development of the world's foremost electro-chemical laboratories. We think that No. 766 is the handsomest battery ever made. But that is a matter of opinion. It is a matter of engineering record, however, that this great standard "B" Battery has proved itself as perfect in performance as we are convinced it is superfine in appearance.



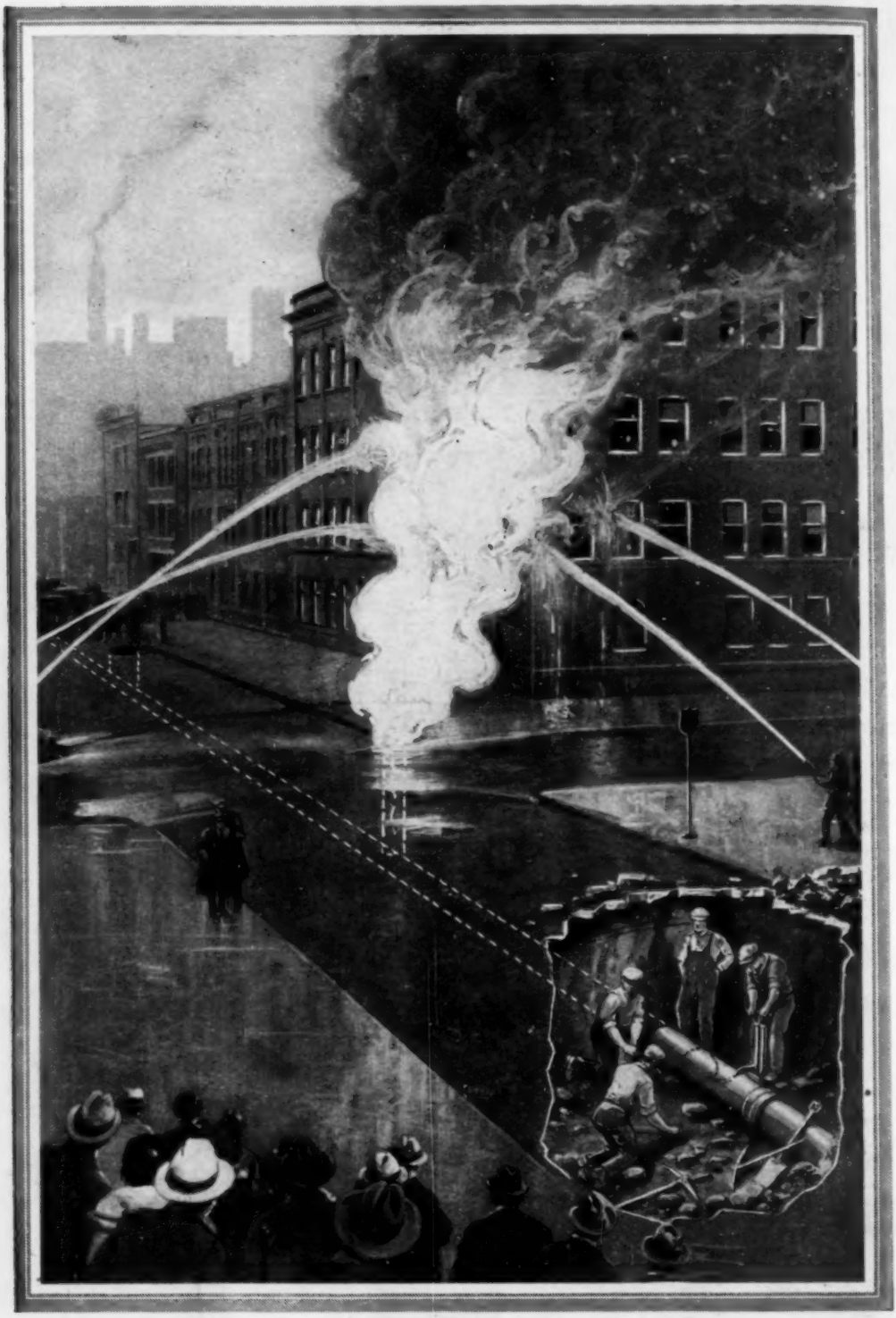
Eveready "B" Battery No. 766
22½ volts. Six Fahnestock Spring Clip Terminals, giving variable voltage from 16½ to 22½ volts, in 1½-volt steps. Length, 6¾ in.; width, 4⅛ in.; height, 3⅝ in. Weight, 5 lbs.

The 45-volt Eveready No. 767 contains the same large powerful cells as the No. 766. For maximum "B" Battery economy, therefore, buy the 22½-volt Eveready No. 766 or the 45-volt Eveready No. 767, as you prefer. Here is the "B" Battery at its best.

NATIONAL CARBON COMPANY, Inc.
Headquarters for Radio Battery Information
New York San Francisco
Canadian National Carbon Company, Limited
Factory and Offices: Toronto, Ontario

If you have any radio battery problem, write to G. C. Furness, Manager, Radio Division, National Carbon Company, Inc., 207 Manley Street, Long Island City, N. Y. Informative and money-saving booklets on "A," "B" and "C" Batteries sent free on request.

EVEREADY
Radio Batteries
–they last longer



How Volcano of Flaming Gas from Leakin[redacted]ithout Interrupting Service by "Plugging Off" a Section [redacted]e Page 565

Popular Mechanics Magazine

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WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 41 APRIL, 1924 No. 4

Science Revolutionizes "Sport of Kings"

Speed of Horses Almost Doubled by Improvements in Tracks, Sulkies, Hobbles, Shoes and Other Equipment

By DONALD M. EWING

(Copyright, 1924)

ALTHOUGH public interest in racing has been revived by the establishment of many new records, few persons realize how much science has contributed to the increase in speed of the horse.

Centuries ago, a pair of Arabian thoroughbreds were imported into England. They became the ancestors of virtually every speedster of today. Yet, their early descendants had a maximum rate of fifteen to twenty miles an hour, while now their progeny travel nearly forty miles an hour.

Science supplies the answer. Progress in mechanics, which brought the inanimate automobile and airplane into undreamed of speeds, has accomplished similar results with living things—horses. The most sensational progress has been with harness horses—trotters and pacers which carry their driver in a two-wheel sulky. As recently as eighty years ago, bets were freely made that no animal could trot or pace a mile in three minutes—twenty miles an hour. Today the record is 1:54⅕ held by Dan Patch—more than 30 miles an hour. Running horses—with jockey in a saddle—travel at a rate of nearly forty miles an hour.

To bring about this speed, science has conquered the elements—wind, water and earth—and has devised numerous mechanical aids to speed and has even tended toward changing the nature and instincts of the animals. Take the harness horses, for there the change is greatest and most recent.

Some eighty years ago, the sulkies used for these racers were heavy contraptions with wheels nearly five feet in diameter and the driver perched high above and behind the horse. The wheels were straight edged. When three minutes for a mile was reached, many thought the maximum had been obtained, but men with a mechanical turn of mind thought otherwise. They found that the straight-edged wheels cut too deep in the turf, retarding the animal. Steel tires were substituted—and it was

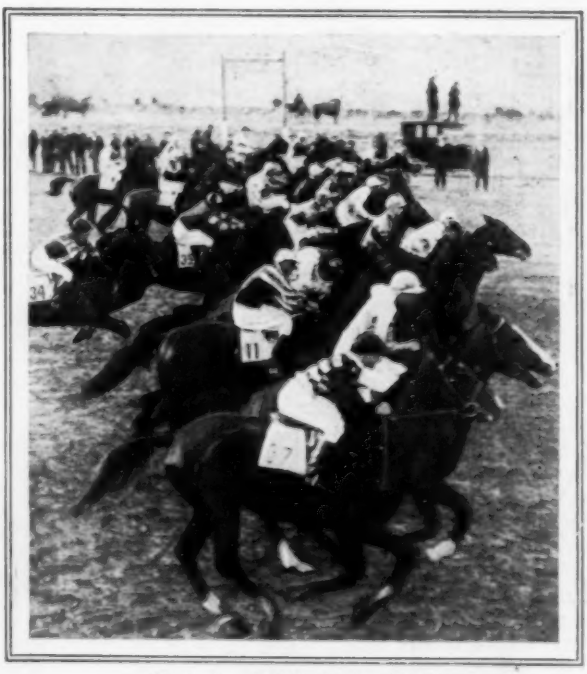
easy to make a mile in three minutes. Gradually, more and more attention was turned to improving the sulkies, until in 1890 horsemen began to dream of a mile in two minutes.

First, the heavy axles of the sulkies were discarded. Inventions came which resulted in an axleless sulky. A light frame was run upward from one wheel, over and down to the other, with the driver's seat in the center. Mathematics enabled light steel trusses to give the exact strength needed without the heavy shaft. With these improvements, Sunol in 1891 made a mile in 2:08¼, the first time 2:10 was beaten. Nancy Hanks also broke 2:10, a year later.

There were still three drawbacks. The sulkies swerved on curves. The drivers, perched high, offered too much wind resistance. The animals sometimes became excited and broke into a gallop, instead of holding to trot or pace.

One single change overcame two of these faults. Low wheels—about two feet instead of five in diameter—with wire spokes and rubber tires were put in. Thus the driver was dropped down behind the horse and offered no obstruction to the wind. The lower-to-the-ground sulky and the rubber tires gave better traction and stopped curve swerving. The result: Dan Patch, with a horse in front as a windbreaker, made a mile in 1:55¼—more than thirty miles an hour against fifteen in the old days. In 1915, Directum I, in a race, won in 1:58½, still the competitive record. Mechanics did it, for it cut the weight of the sulkies from sixty-five to thirty pounds besides making them better in many other ways.

Then hobbles were invented. They are rope-like contrivances, from leg to leg, which keep the horse from breaking out of trot or pace. They helped also in training. On this angle, horsemen also found, by experiments, that light shoes in front produced a pace and heavy shoes a trot. Thus, even the horse's instincts were guided by science.



Start of a British Racing Classic

Running is a horse's natural gait. Running races started centuries ahead of the harness type. Thus, the improvements made there greatly antedate the harness type, but the progress has been about the same. First came the changes in starting. Once a drummer started the animals and they always got away slowly. Today, the starter presses a

button, a web-like barrier in front of the animals shoots outward and upward and they're off. The very quickness of the barrier seems to urge the horses on. Then there are the timing devices which authenticate the speed. In old days the timer used a "Big Ben." Then came the split-second stop watch and now electrical timers which run to the tenth of a second. Electric score boards give the spectators results almost as quickly as the judges gets them.

Plates—shoes—brought a big improvement in runners. Aluminum was substituted for steel because it was lighter. Thin half-inch wide aluminum plates are easily put on or taken off, and the horse does not carry the heavy steel shoe of olden days. Different types of plates are used for different track conditions. Stirrups are lightened through the use of aluminum, as are saddles and bits.

Many mechanical contrivances were produced only to be barred later. Electricity furnished the greatest. Years ago horses were given a bottle of wine before a race to pep them up. In the early '90's, Jockey Kuhn, riding for Louis Merriwether Clark, of Louisville, carried a small battery inside his shirt. Wires ran down to the spurs. A jab of the spur gave the horse a sharp electric shock and he lunged forward for a quick start.

When these were barred, crooked owners had the jockeys carry the battery hidden in their hands, throwing it away after the start. Then came the electric whip—with a battery in it—and the saddle with an electrical contrivance concealed inside which operated when the jockey pressed a button. All are barred now.

But the greatest aids to speed—both in running and harness races—came through civil engineering—the construction of tracks. Old tracks were mere measured-off pastures. In 1884, railroad engineers built the first dead level track at Washington Park, Chicago. It was drained and the surface scientifically made. All modern tracks are engineer-built.

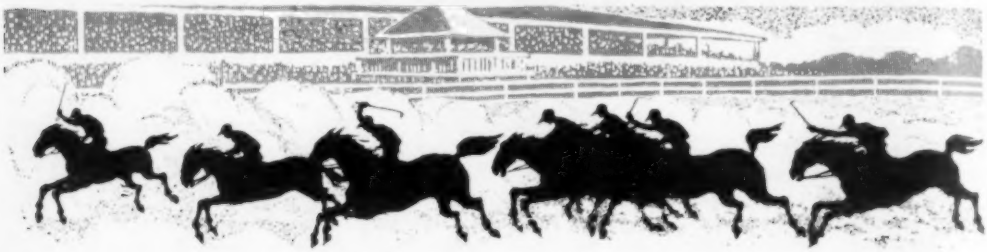
Experimenters soon found that the harder the surface the faster the speed. But they also found that runners would sprain their legs on hard tracks because of their big lunges. Trotters and pacers with short, quick strides did not suffer in this way.

Steel and leather ankle braces were designed for

Copyright, Underwood & Underwood
Italian Cavalryman in Hurdle Race

runners. But they were not enough. So, special tracks were built for each type of horse—hard for harness animals, hard underneath but soft—yet firm—on top for runners. Experiments proved that an undulating or wavy surface was best for runners, for the downhill waves were placed at the right distance to catch the end of each stride and rest the animal. Harness horses, however, had to have a "dead-level" surface. So, the level and transit were called on and the undulations put in—not perceptible to the eye.

So, in 1918, Roamer ran a mile at Saratoga in 1:34⅘. Yet Roamer's ancestors—the equine Adam and Eve—couldn't even approach that rate of nearly forty miles an hour. Horsemen will tell you that scientific breeding has done much to increase speed. True, of course, but science in the form of mechanical changes has done its part, too.



HALF WORLD'S ELECTRIC LIGHT USED IN UNITED STATES

Incandescent lights of the kind used today have about four times the efficiency of those of eighteen years ago, electrical experts have estimated. It is computed that there are 350,000,000 electric lamps in the United States, about equal to the number in all the other countries of the world combined. The increase is placed at approximately ten per cent each year.

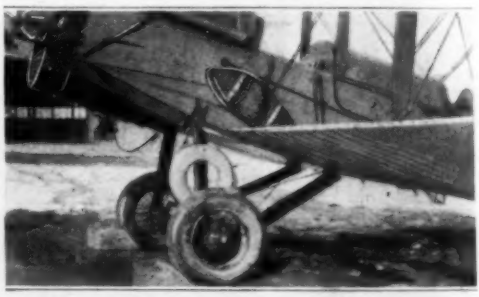
FAST, BANDIT-CHASING AUTOS PROOF AGAINST BULLETS

Bandit-chasing automobiles have been put into service by the Philadelphia police in their campaign against crime. The cars are equipped with bullet-proof bodies and windshields, and the specially built motors make them capable of a mile-a-minute speed. Detectives assigned to ride in them carry high-powered rifles and shotguns.

Armored Automobile with Specially Built Motor Used in Campaign against Crime

SNOWSHOES ON MAIL PLANES AID IN MOUNTAIN FLIGHTS

Air mail planes flying over San Francisco bay and the high Sierras between the Golden Gate and Reno have been equipped with snowshoes and life preservers. The shoes are expected to be of assistance in case of forced landings in the snow-capped mountains. Although few accidents are reported, owing to the rigid inspection of the airplanes, the first consideration of the service is to safeguard the aviators.



Air Mail Plane Equipped with Life Preservers and Snowshoes for Flight over Mountains

¶Agriculturists fear that an insect pest, the Australian tomato weevil, recently discovered in the South, will become of great menace to crops unless suppressed.

MORE FLOWERS GROWN YEARLY TO SUPPLY PERFUME

Acres of roses, violets, lilies and other flowers are raised each year in France and southern Italy, to supply the world's demand for perfume which is said to be increasing every year. To extract their fragrance, millions of freshly picked blossoms are placed upon sheets of glass covered with lard which absorbs the oils exuded by the flowers. Repeated layers of blossoms are required before the lard is fully saturated. When this process is complete, the concentrated extract is obtained by melting the lard and dissolving it in purified alcohol which leaves only the valuable, essential oil. This is further treated or mixed with other substances to give it the required quality and strength. In southern Italy, large distilleries have been erected recently for the extraction of valuable oils from the rind of the citrus fruit that yields essences used in the manufacture of perfumes.

MEDICINE IS FED INTO LUNGS OF WHITE-PLAGUE VICTIMS

For the treatment of pulmonary tuberculosis a medicine is being used that is inhaled directly into the patient's lungs through a tube and mouthpiece. It is composed of amorphous carbon and calcium salts which, it is declared, build up

Tuberculosis Patient Inhaling Medicine which Is Declared to Arrest Progress of the Disease

the fibrous tissues, arresting the progress of the disease. Good results are declared to have been obtained in experiments in the east.

"SPEAKING FLAME" GIVES VOICE TO TALKING MOVIES

Realistic reproduction of the tones of the human voice is given with a microphone that is known as a "speaking

Microphone that Converts Electrical Impulses into Sound Waves without a Diaphragm

flame." It is expected that this device will do away with the ordinary vibrating diaphragm, such as is used in the telephone, and that it will be of service in the movies. With it there is almost no distortion in converting electrical impulses into sound waves.

PATENT OFFICE GIVES WOMEN A SPECIAL DEPARTMENT

In the patent office at Washington there is a woman's department, with the specifications ranged in the order in which they were received. The first on the list is a patent taken out in 1809 by Mrs. Mary Kieser for a process of weaving straw hats with silk. One woman inventor, Hannah Lord Montague, is honored by a public memorial in Troy, N. Y., where she was born. As Mrs. Montague was doing the family washing on a hot summer day in 1825 it occurred to her that a shirt remained clean for a longer period than a collar, so when her husband's shirts were dry, she detached the collars from them. Later she started making detachable collars for sale to her neighbors, and the demand reached such proportions that before 1840 several factories of "string collars," as they were called in their infancy, were established in Troy.

Mystery Ray Is Revealed By Photos

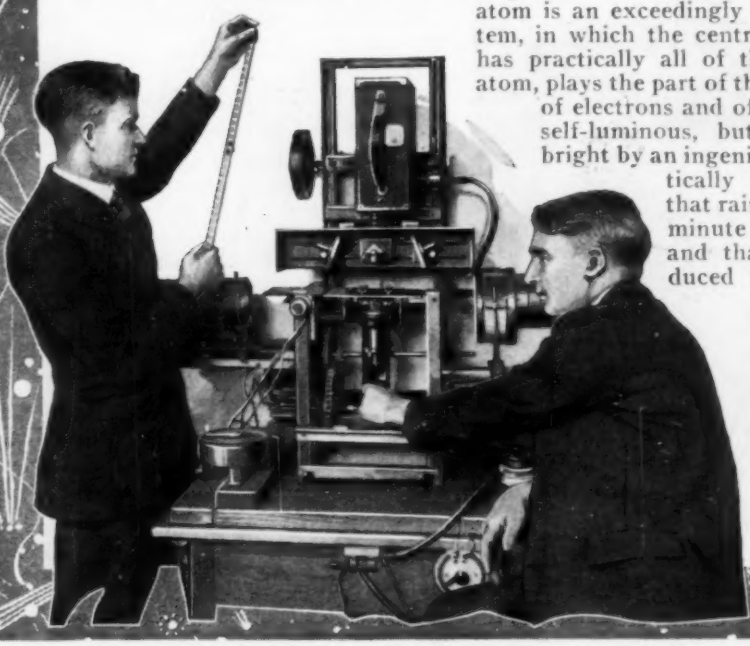
By WILLIAM D. HARKINS
University of Chicago

Luminous Paths of Incredibly Small Particles that Move at a Speed of Ten Thousand Miles a Second

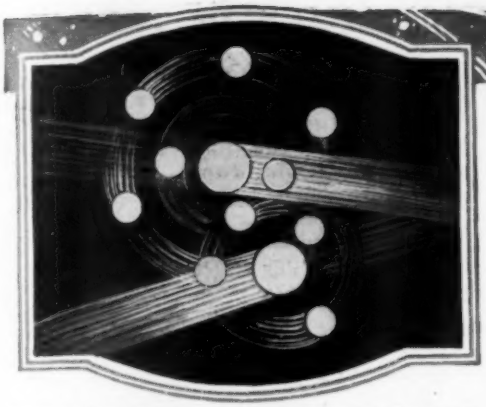
RAYS of a new type, called zeta rays, were discovered recently by Dr. R. W. Ryan and the writer. These rays have attracted much attention, presumably because they were first found by photographing them, or, more strictly speaking, by photographing the tracks they produce when they shoot through air. They are not light rays, but are electrons, or charges of negative electricity, thrown out by an atom.

All owners of radio outfits are familiar with the use of electrons shot out from a hot wire, since it is the stream of these particles of matter which is made to do various "stunts" in the different types of vacuum tubes. Such a stream of electrons is also shot out from the hot wire in every electric lamp, and may be collected on a metal plate if it is inserted inside the bulb.

While an atom is so small that it takes a hundred million in a straight line to reach an inch, electrons are very much smaller. Certainly one of the greatest discoveries of the twentieth century was made when C. T. R. Wilson, of Cambridge university, found a way to make the tracks of these exceedingly minute particles visible as dotted lines of light. The nucleus of a helium atom, or the central part of it, is supposed to be nearly as small as an electron, but carries two positive, instead of one negative charge. If this helium nucleus, usually called an alpha particle, is shot through air at high speed, it produces a track like that of the electron, except that the line of light is continuous and brighter. It may be explained that an atom is an exceedingly minute solar system, in which the central nucleus, which has practically all of the weight of the atom, plays the part of the sun. The tracks of electrons and of the atom are not self-luminous, but they are made bright by an ingenious device. Practically everyone knows that rain clouds consist of minute drops of water, and that these are produced by cooling moist air. Now these drops will not collect in dust-free air, except upon charged particles, that is, upon electrons.



Searching Movie Film for Traces of the Mysterious Zeta Ray



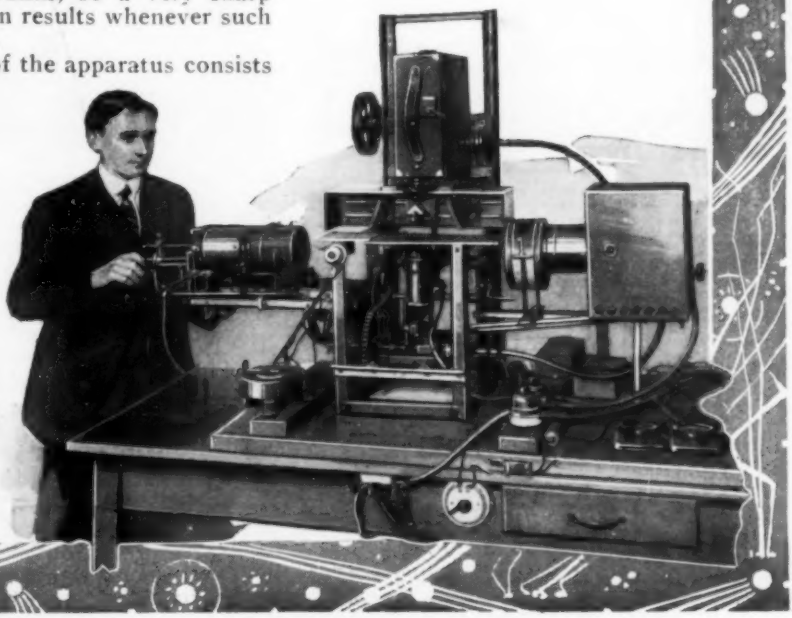
Minute Solar System Formed by Electrons Constantly Whirling About a Center Like the Planets

Electric Charge Made Visible By Film

or upon atoms which are charged with positive electricity and are known as positive ions. What is done is to put air or another gas into a glass cylinder provided with a flat top and with a piston for a bottom. The gas is kept moist by wet gelatin. On one of the walls of the cylinder a minute particle of a substance similar to radium is fastened. In these experiments thorium C, which is very much more powerful than radium, in that it shoots off alpha particles with twenty-six thousand times the velocity of the fastest rifle bullet, was used. When these high-speed particles shoot through a gas they travel so fast that they have no time to pass around the atoms, so they go straight through them. Very rarely the alpha particle hits the nucleus of the atom through which it is passing, and rebounds, so a very sharp change of direction results whenever such a collision occurs.

The operation of the apparatus consists in suddenly pulling down the piston, thus expanding and cooling the moist air. Water drops form immediately, but only upon the electrons pulled out of the atoms, or the positively charged atoms from which electrons have been pulled, and these occur only in the line in which the fast alpha particle has moved. The brilliancy of these lines of minute water drops is due to the fact that two powerful searchlights are focused upon them.

The interest of the zeta rays results from the fact that they are exceedingly rare. Also there is no explanation of their peculiar form. They are about an eighth of an inch long and are highly curved. The discovery of these rays was partly accidental, though we were looking carefully for peculiar ways in which electrons may be ejected from atoms. The rays were found in photographs taken to show collisions between an alpha particle and the nucleus of an atom. Forty thousand such photographs were taken, and it is now planned to obtain two hundred and fifty thousand more.



Producing Charged Particles in Cylinder to Reveal Paths

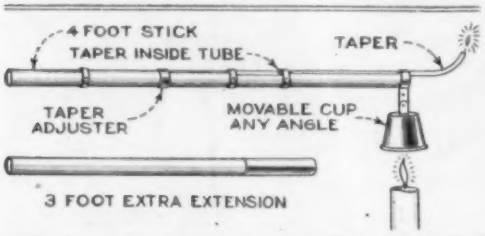
COTTAGE BUILT ON AUTO GIVES TOURISTS HOME COMFORTS

Fitted upon the chassis of a small touring car, a miniature cottage supplies an Iowa contractor, his wife, and two children with luxurious quarters while on motor tours. Electric lighted throughout, the house provides ample protection from dust and rain, there is space for a cradle for the baby and other comforts of home. The front window in the roof gives the driver a full view of the road ahead and glass in the rear makes it possible to see behind. Entrance is provided by a side door and one at the rear. The radiator fills the screened-in "porch" which has one side on hinges so that the engine can be reached easily. The cottage weighs but little more than the inclosed body of standard type and proves an effective advertising device.

Comfortable Cottage Touring Car that Sheltered Family of Four on Cross-Country Run

NO-DRIP CANDLE EXTINGUISHER HAS TAPER INSIDE TUBE

To prevent the soiling of altar linen, a non-drip adjustable candle extinguisher has been patented that also will extinguish the light without touching the wick. The taper is carried in a four-foot tube to which a three-foot extension may be attached. Because of the design, no grease can lodge in the extinguishing cup.



Candle Extinguisher with Taper Concealed Inside Tube to Prevent Dripping on Altar Linen

UNCLE SAM BUILDS HIGHWAYS ENOUGH TO CIRCLE EARTH

More than 8,000 miles of roads of all types were completed with federal aid during the year which ended June 30, 1923, according to a government report. This, added to the mileage completed previously, brought the total for finished projects up to 26,536 miles, or more than enough to circle the earth. The projects under construction at the close of the year amounted to 14,772 miles, and were estimated at 53 per cent complete.

SEALSKIN FENDERS PROTECT BOATS OF ESKIMOS

Skins of the leopard seal, also known as the sea leopard because of its spots, are put to a variety of uses in the frozen north. To the Eskimos, they are more valuable than the pelts that produce the luxurious wraps so highly prized in warmer lands. Blown up like balloons, the skins are placed on the prows of hunters' boats to protect the sides of the fragile craft from the sharp, jagged edges of ice floes. Like fenders, these bumpers ward off the jabs of the ice cakes and on rocks and portages they act as rollers for the craft. Sacks also are made from them and they hold the family supply of blubber and oil. Their light weight makes them the favorite containers for freight that is to be handled by dog or reindeer teams.

Sea-Leopard Skins Blown Up for Bumpers to Protect Boats from Ice Cakes

ONE-MAN WATER PLANT SUPPLIES WHOLE CITY

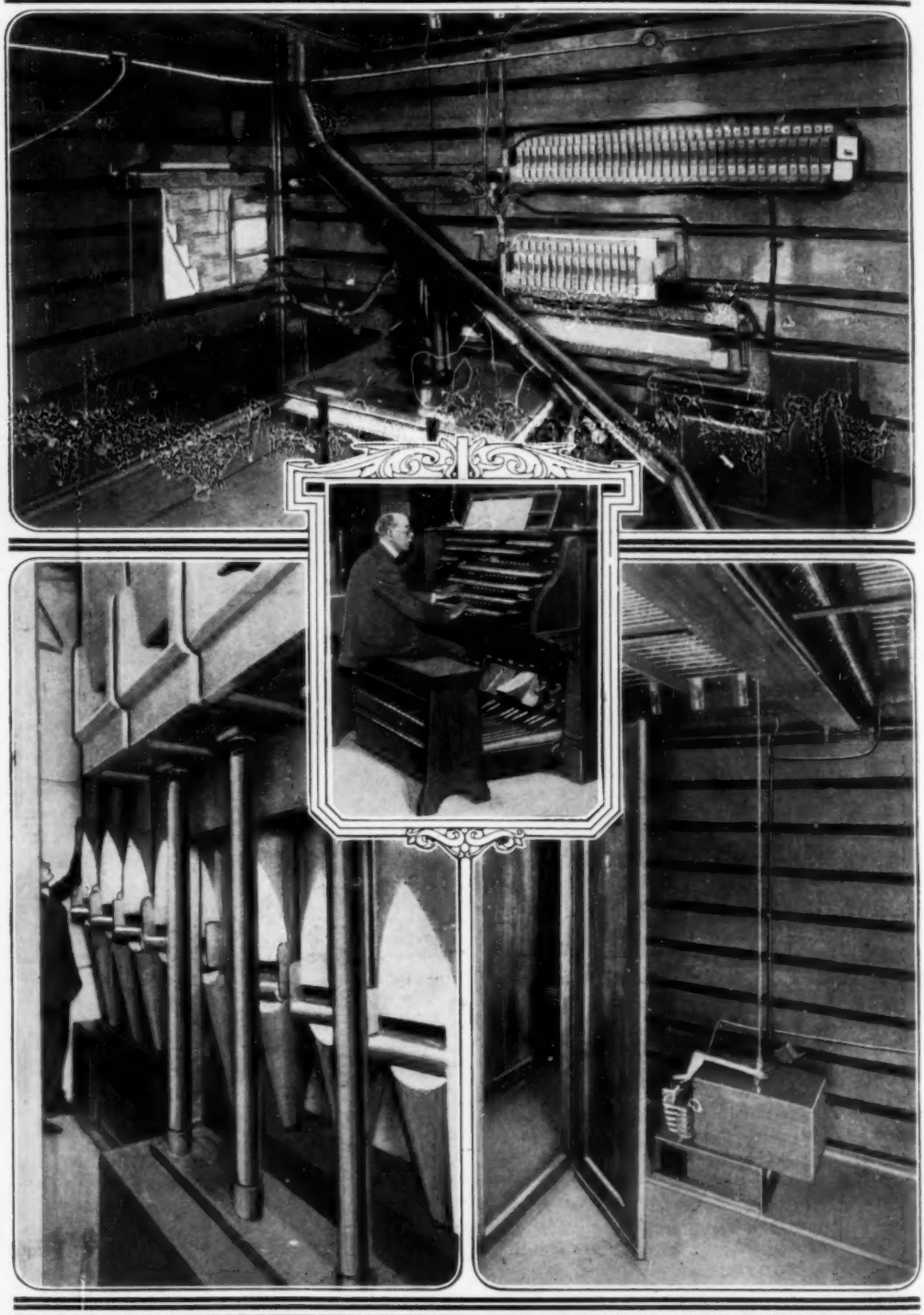
Taking the muddy and contaminated waters of the Sacramento river, purifying them with alum and chlorine gas, and filtering them through sand until they sparkle like crystal and are free from germs, the vast filtration plant that supplies California's capital city with 48,000,000 gallons of pure water each day, represents a triumph in sanitary engineering. The plant was opened with the closing of a switch by a young woman stenographer on order by radio from President Coolidge, after several years and over $3,000,000 had been expended on its construction. Housed in artistic buildings set in a tract of approximately 50 acres which is to be used for a municipal park, the elaborate apparatus of the plant is electrically driven throughout and may be controlled by one person from a single switchboard. Included in the works are an intake pier, pumping station, grit removal and storage basins, coagulating tanks, sedimentation basins, head house and filters, clear-water reservoir, force mains to the city and an alum manufacturing plant.

Interior of Pumping Station in Sacramento's New Water Plant: A Battery of Low-Lift Pumps for Starting the Supply on Its Way through the Filtering Process

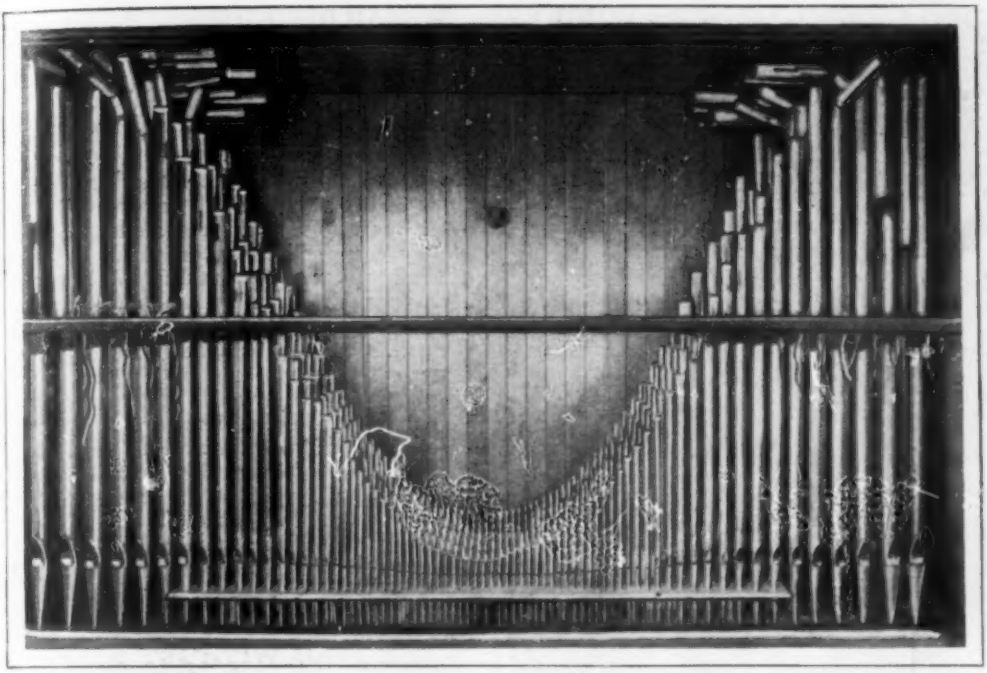
TOKYO CORRESPONDENT TELLS OF A "NOBLE INVENTION"

In report No. 176 from this magazine's Japanese correspondent, N. Sakata of Tokyo, the latter speaks of a new parachute for aviators just put in use by the Japanese army air service. It seems that details of construction have been withheld, but the following is the correspondent's statement:

"This idea caused one of investigator in the army air service field to invent the new wonderful device which was honored by the minister of army recently. His invention is to ignite the device electrically in very short minute and to cause open the parachute in full condition. Then you can save your life by hanging from it safe. When the airplane body is shown the symptom of some danger and lose its usual state, the electricity will flow up respectively, as I told above, and cause the small gas-contained bag to be ignited. This ignition will open the parachute in full. At this time the body will descend down with enormous speed, but the parachute is already in action. This noble invention of the army is strictly kept from announcement on account of army's usual way."



Electrical Control (Top); Organ Keyboard (Center); Mouth of Several of the Pipes (Left), and Wind Chest that May Be Entered During Concert (Right)



Floating String Organ Unit, Consisting of about Five Hundred Pipes; the Twisting and Doubling over of the Tubes Does Not Affect Their Tone

Huge Organ Has Six Thousand Throats

Thirty Thousand Miles of Wire Form Nerves of Instrument for Which Fifteen Electric Motors Supply Power

AS you listen to the majestic tones of a great pipe organ mere mechanical things seem far away, but behind that proscenium arch is an electrical and pneumatic system of intriguing complexity.

More than 30,000 miles of wire form the nerves which control the 6,000 throats of one of the largest organs in America which has just been completed at the University of Colorado in Boulder.

What looks like one organ, however, is really seven—the great, the choir, the solo, the pedal, the swell, the echo, and the floating string units—which, played as one, produce every tone possible to a symphony orchestra, except those of the percussion instruments, such as the drums.

Back of the stage is the successor of the small boy who used to pump the church organ—a huge turbine, driven by a thirty-horsepower electric motor, blowing air into the seven wind chests which supply each organ. But even this is not large enough and a ten-horsepower auxiliary motor and turbine automatically start to operate at peak loads. Air-lock doors, something like those used in tunnel-construction work, permit a workman to enter the chambers without altering the air pressure. Thus the valve mechanism can be adjusted or repaired while a concert is in progress.

Electromagnets, controlled from the keyboard by the organist, move the thin strips of wood which operate the valves regulating the flow of air into the pipes which are made of silver, tin, zinc and lead.

Some pipes are doubled over. Others are turned in loops and circles like a cornet horn. Some taper; others have bell mouths. Many are stopped to produce a slightly softer tone. A few have a "beard" hanging over their mouths which slightly alters the tone.

Seven brick boxes with electrically operated steel shutters, enable the organist to control the volume of sound from a faint whisper to a crashing roar.

Fifteen electric motors furnish the power to operate the various units of the organ.

DOG KENNEL OUTSIDE WINDOW SOLVES A CITY PROBLEM

Keeping dogs in city apartments is simplified by a kennel placed outside the window. The inclosure is made of lath and

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Window Kennel for Dog Is Easily Reached, Well Ventilated and Out of the Way

affords the dog a constant supply of fresh air. It is readily accessible through the window which opens and closes as the door to the pen.

AUTO DEATH IN U. S. EVERY THIRTY-FIVE MINUTES

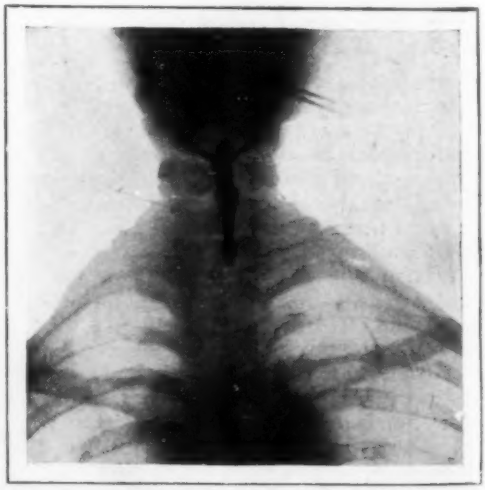
Every time the clock recorded thirty-five minutes during the last year, a person was killed on the highways of the country, and each minute, approximately three persons were injured, delegates to the convention of the American road builders were told. In twelve months highway accidents claimed a total of 15,000 lives and caused 1,700,000 injuries, according to the figures given. Uniform traffic regulations, established by all states, strict enforcement of these laws, systematic maintenance of roads and safety education in schools were urged to curb the ever mounting number of fatalities. In Wisconsin, a survey of accidents during the past two years was said to have proved that most of them occurred on straight roads, largely due to attempts of drivers to pass one another. Railway grade crossings, however, were declared to be the most dangerous.

WOMAN BIRD SURGEON TREATS ILLS OF FEATHERED PETS

Acting as a surgeon for birds is the occupation of a New York woman who performs operations upon her feathered charges and cares for their various ills. Rheumatism, indigestion and fevers are some of the ailments she has treated. Surgical operations are performed in a completely equipped room on the third floor of the hospital she maintains. With several assistants, she is called upon to minister to the needs of more than 2,000 birds in the summer months when families leave for vacations and bring their pets to be "boarded" in the wards of the hospital while they are gone. The birds like to be amused and show interesting characteristics, their keeper declares. Balls, beads and ribbons hung from the cages keep them from pulling out their plumage and music from a phonograph seems to cheer them when their own songs are silenced.

CRUCIFIX IN THROAT TEN DAYS REMOVED WITHOUT KNIFE

After lying for ten days, imbedded in the throat of a patient in a Boston hospital, a crucifix, two inches long, was extracted without surgery. X-rays located the obstruction and, although the victim was at the point of strangulation, no knife was used, despite the fact that the prongs had become lodged in the sides of the windpipe.



How the X-Ray Located a Two-Inch Crucifix Caught in Woman's Throat

Fastened in an upright position, the cross arms are believed to have prevented the piece from penetrating further.

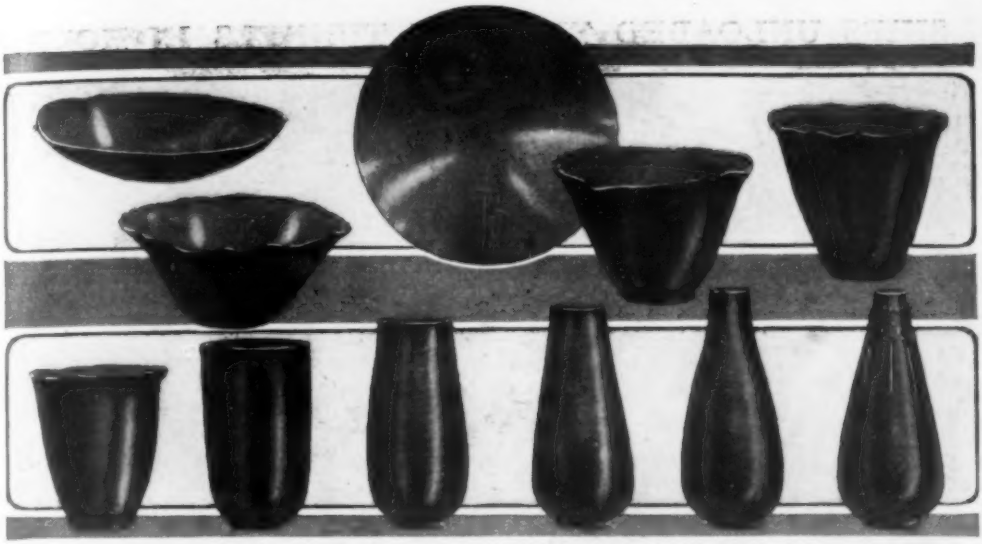
Hues of Rainbow Rivaled in Copper

CROWNING one of the oldest crafts with new beauty made possible by modern knowledge of chemicals, Jean Durand, a French metal worker, has achieved unique and beautiful effects in hand-hammered copper and brass ware, samples of which were exhibited not long ago in Paris salons. Floral designs and other patterns are worked into the various articles in enamels by a secret process that is said to reproduce the natural shades of petals and leaves in their original brilliance and freshness. "Futurist" figures, also worked in colors, add a novel touch to the product of this artist's workshop—vases, bowls, gongs and pitchers that rival in symmetry and delicate form those fashioned by workers centuries ago. From a flat disk of metal, the object takes form under strokes of hundreds of wooden and metal hammers of various shapes and sizes. Each of these tools is used at some time during the hammering process on different pieces. The pounding is begun at the center of the disk and extended outward until the edges have been tapered off to the proper curve. Frequently as many as forty alterations are necessary before a vase is correctly modeled.

Finally hammered into shape, the article is ready for the heating process, a step taken to soften the metal for the engraving and enameling. Any pounding necessary after the metal is heated is done with steel

Filing and Chiseling the Finishing Touches on Ornamental Pieces for Hammered Bowls and Vases

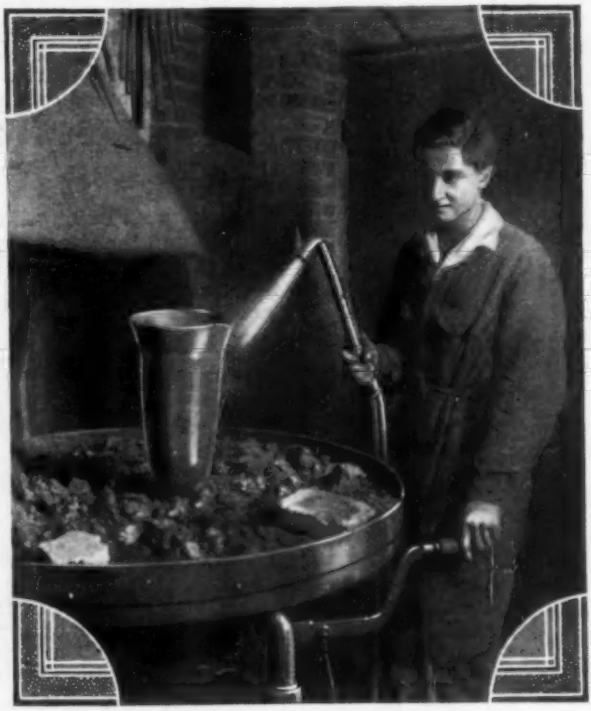
Shaping a Flat Disk; Above: Plates and Bowls, Samples of the Modern Coppersmith's Art, a Combination of the Antique with Up-to-Date Methods of Craftsmanship



"Growth" of a Vase from a Flat Metal Disk Shown in Upper Center

hammers to give sharp outlines. Relief work is placed by tapping the surface with a sharp steel bar to raise small dents on the sides of the bowl or vase. This work requires great skill with the hammers, as too much force will spoil the outlines and make the indentations too deep. Engraving tools of various kinds, files, chisels and gauges are employed in the final stages, and after the color design has been completed, a finish, dull or polished, is placed upon the article.

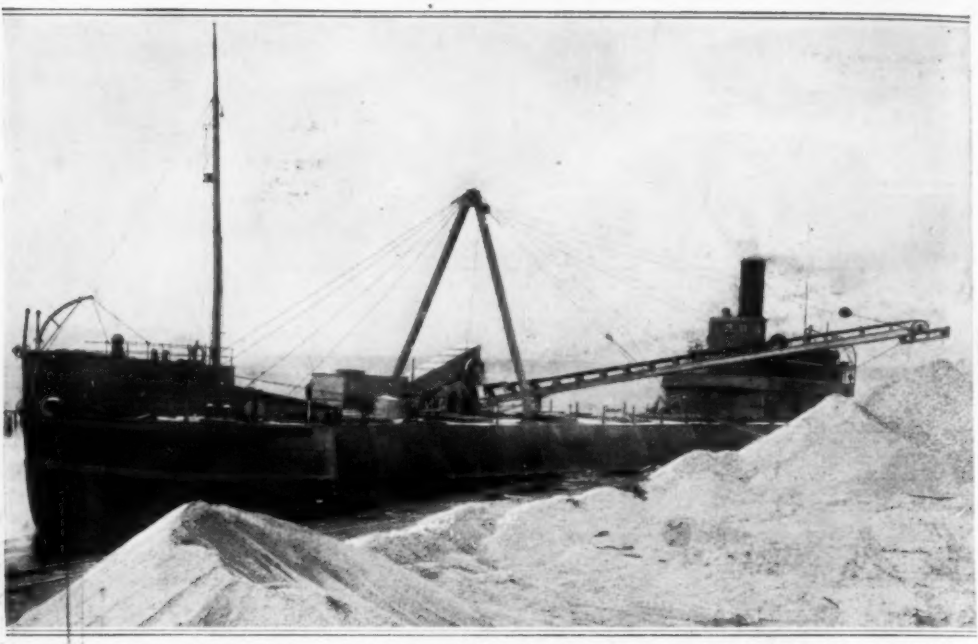
Among the objects fashioned by this artist is a helmet designed for Marshal Foch, said to be one of the finest pieces of workmanship ever made by a coppersmith. Surmounting the headpiece, visor and wreath, worked in various metals employed in branches of the armies during the world war, is the head of a cock with brilliant crest and with glittering feathers. The art of hammered metals, little practiced where machinery has supplanted hand tools, was known to the Assyrians and Egyptians several centuries B. C., and is still commonly practiced in Tunis and Algiers. In modern countries, it is little known except where highly trained workmen, with patience, follow the exacting requirements of the craft.



Heating the Metal with Torch Flame to Soften It

Copper tools and utensils found in Egypt show that the metal was used before the pyramids. Some of the oldest objects were colored, an enamel background being applied over the entire surface before the designs were painted. A threatened shortage of the metal, experts believe, may be averted with the development of radio.

SHIPS UNLOADED THROUGH TUNNELS IN HOLD

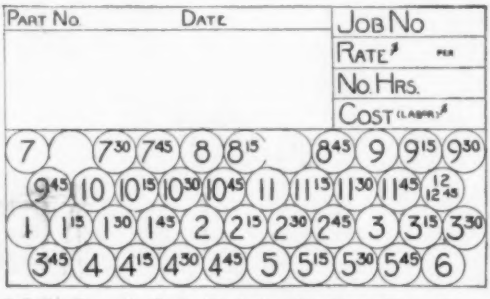


Unloading Cargo of Crushed Stone with Automatic Rigging Installed in an Old Lake Freighter: The Belt Conveyor Placed the Material where It Could Be Reached Easily

Freighters on the Great Lakes are being equipped with a recently invented unloading device that is said to result in a saving of labor and time. Two open-sided tunnels are constructed on the cargo floor of the vessel. Through these operate large, bottomless drag scrapers supported by an overhead trolley. Digging in with a steam-shovel action, the scrapers dump the material on a conveyor belt which discharges on deck. In a recent test 2,500 tons of crushed stone were unloaded in eight hours. Greater utilization of space, economy in operation and comparatively low cost are features claimed for the system as a result of recent tests.

PAYROLL CARD SYSTEM HELPS IN AVOIDING MISTAKES

Time, expense and mistakes in computing pay of employes of a large eastern company who work on an hourly basis are saved with the use of a system of cards that indicate the length of time a man has worked and the exact amount due. When a task is started, a card, marked in fifteen-minute intervals from 7 o'clock in the morning until 6 o'clock in the evening, is punched to show the beginning hour. Another perforation is made on quitting. This card is placed upon a master card which shows the labor prices in progression from fifteen minutes up to and including eleven hours through the perforations. For the various kinds of work, seventy master cards are used in a handy index so that they may be found immediately.



Sample Payroll Card Marked with Forty-Two Hour Divisions for the Timekeeper's Punch

¶Popular Mechanics Magazine does not publish the name of maker or seller of any device described in its pages, but this information is kept on file and will be furnished free by addressing our Bureau of Information.

PHONES FOUND TO BE BUSIEST DURING MORNING HOURS

Rising and falling throughout the day, the distribution of telephone calls has been likened to the pulse of a city's activities. To show these fluctuations with accuracy, a chart has been made of the amount of business handled by the exchanges in New York City. Until five o'clock in the morning the number of calls is negligible, and may be considered as zero. A slight increase sets in a little after that hour, and by six o'clock the curve begins to sweep upward, reaching its highest peak for the day at 9:30. Then follows a slow decline until 11:30, when the curve suddenly takes a sharp downward turn and falls until 12:30, the lowest level of the business day. The highest point during the afternoon is at 1:30, after which there is a steady decrease.

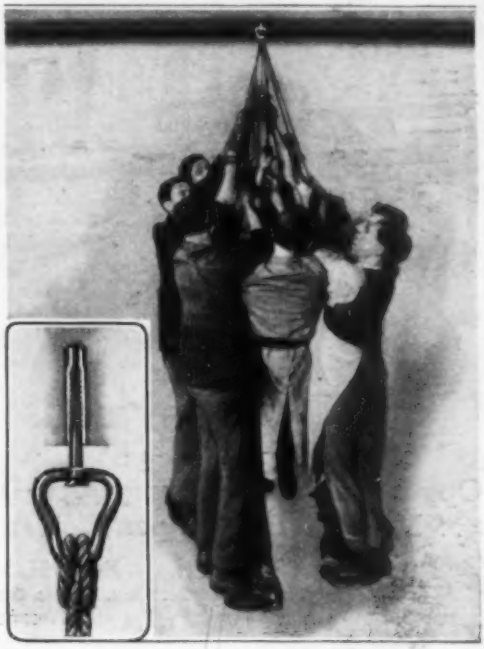
POCKET-SIZE GAS STOVE COOKS MEALS FOR CAMPERS

For the convenience of sportsmen and campers, a tiny stove that fits into the pocket and burns gas from a small, portable tank with a supply sufficient to cook twenty-five meals for four persons, has been invented. Connection is made through a leakproof rubber tube and the stove is lighted at the turn of a cock. Danger of forest fires is largely eliminated with this arrangement, smoke and sparks are avoided, a hot fire is assured, regardless of the weather, and there is no dependence on wood for fuel. At night, the gas provides a convenient light for reading, playing cards or for other purposes. The tank weighs only a few pounds. When empty, it is changed for a full one.

Pocket-Size Gas Stove Attached to Tank that Holds Supply for Several Meals

FIBER PLUG HOLDS SCREWS SUNK IN STONE OR IRON

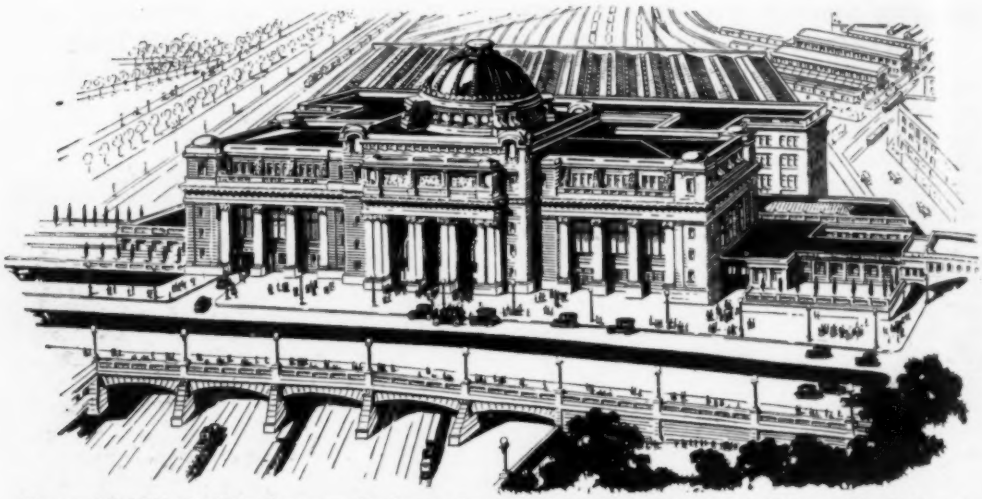
For holding screws firmly in stone, iron and similar materials affording no grip for the threads, a fiber plug is being manufactured by an English concern. Cylindrical in shape, it is inserted in a hole made by a drill and becomes a bed for the fastener, expanding against the sides of the opening as the screw enters, thus resisting any outward pull upon it. Used as an insulator in electrical work, it is said to serve in attaching wires to metal beams. It is claimed also that with it bathroom and light fixtures can be safely held in place in the most brittle compositions without danger of cracking the wall surfaces.



Fiber Plug to Hold Screws in Stone or Iron, and Illustration of Its Strength

BISCUITS AND RADIO IN COURSE GIVEN ON FLOATING SCHOOL

Equipped as a model floating school, the power schooner Boxer has sailed for southeastern Alaska where the officers will undertake to teach the natives various trades, including wireless telegraphy and navigation. The voyage is being made under the direction of the United States bureau of education. One feature of the program will be instruction in modern cooking.



Proposed $10,000,000 Main Passenger Station, an Important Link in the $80,000,000 Chain of Illinois Central Railroad Improvements in Chicago

Railways' Needs Vital to the Nation

Opportunities for Young Men Declared to Be Great as Ever with Millions Being Spent for Improvements and Betterments

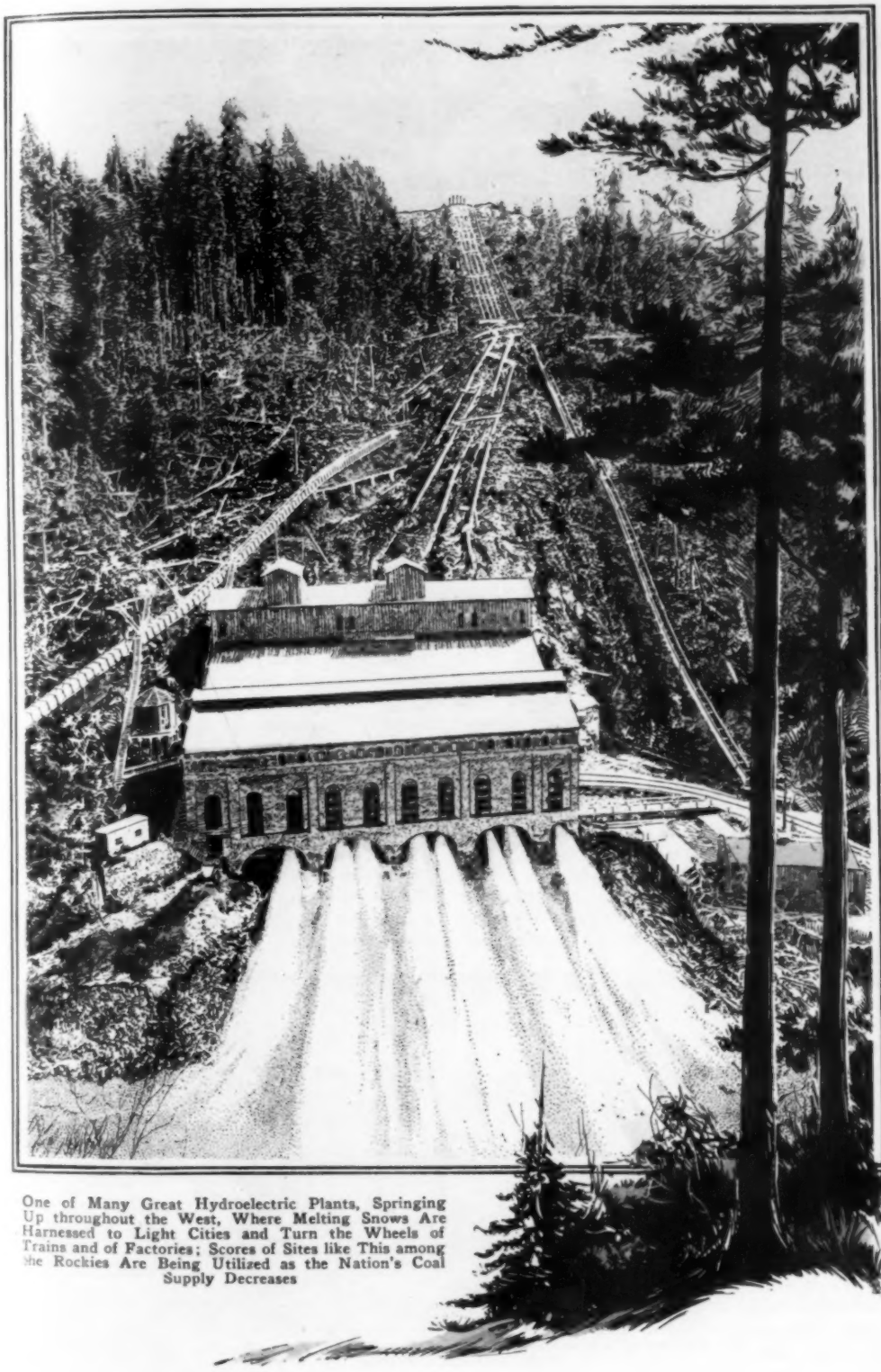
By C. H. MARKHAM
President, Illinois Central Railroad Company
(Copyright, 1924)

IT has been well said, in effect if not in these exact words, that men do not in reality make laws; they merely discover them. To the extent that legislation is in accordance with the moral and economic principles that govern our relations one with another, such legislation is likely to be productive of good results. To the extent that legislation ignores and runs counter to these principles, it is likely to be destructive. Good laws are nothing more nor less than common sense solidified and made permanent.

The greatest need of the country in its consideration of the railway situation today is a close adherence to common sense. We hear more talk about "government ownership of railroads" than we do about the rights of private property, more about "watered stock" than about the danger in the excess of bonds over stock in present-day railway financing, more about "inflated valuation" than about the right of the railroads to earn a return upon their actual worth, more about "restrictive rates" than about the foolishness railway executives would display by advocating such rates, more about a "guaranty" than about the fact that the railroads would have to be allowed some reasonable return under any kind of law.

Take the question of government ownership. The railroads are private property; they were conceived as private property; they grew to greatness as private property; they took their share of the country's business reverses as private property, and it is not fair, it is not common sense, that they should be denied the opportunity to get back on their feet and to serve the country as it should be served, still as private property.

If public service is to be the test of business that must be nationalized in any near-socialistic scheme of government, then the railroads undoubtedly would not be the only form of private property abolished. The railroads represent more than seven per cent of our national wealth. They are the life blood of and furnish the stimulus for agriculture and manufacturing, the value of which in 1920 was estimated as more than $120,000,000,000. When this keystone of our industrial arch is taken into government ownership, what can be said for the future of the rest of the country's business—indeed, for the institution of private property itself?



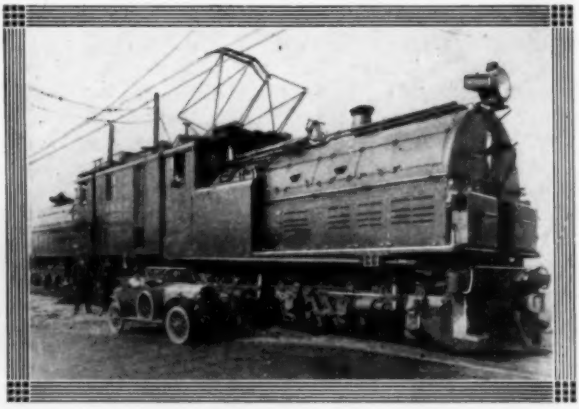
One of Many Great Hydroelectric Plants, Springing Up throughout the West, Where Melting Snows Are Harnessed to Light Cities and Turn the Wheels of Trains and of Factories; Scores of Sites like This among the Rockies Are Being Utilized as the Nation's Coal Supply Decreases

Track-Raising on Part of a Fifty-Mile Stretch to Eliminate Dangerous Grade Crossings and Insure Safety and Speedy Transportation for 300,000 Commuters Daily

In writing thus of government ownership, I advocate, strangely enough, the interest of the public as opposed to that of the present-day railway owners. Railway investors stand to lose nothing if the government takes over the railroads, since the bonds they would undoubtedly receive in return would draw a steady and a certain rate of interest, guaranteed by the credit of our nation; under government ownership, which certainly would not be accomplished by the confiscation of the value of their property, the present-day railway owners would be freed from the constant threat they now have of a reduction or disappearance of returns. Common sense tells us that the real sufferer from government ownership would be the public, not the present owners of the railroads; the rights of private property which would be invaded would be those, not of the railway owners, but of the public in general.

Common sense tells us that there is less to fear in the time-worn bogy of watered stock than there is in the fact that restricted railway earnings have made present-day railway financing almost altogether by bonds. In other words, instead of taking new partners in the business, the railway owners have been forced to mortgage their improvements as they have made them, until today more than half of the railway investment is represented by bondholders and less than half by the holders of stock, who take the great risks of the business. This is an unhealthy condition, and the only way to remedy it is to assure adequate railway earnings in the future, which will restore railway credit and act as a magnet to draw new partners, as distinguished from new mortgagees, into the business.

But perhaps the greatest value of common sense in any discussion of the railway situation is to dispel the clouds that gather about the much-disputed matter of inflated valuation. Probably nine out of every ten persons who argue for a reduction in railway valuation by a half or a third do so in the belief that such action would promptly cut railway rates an equal proportion—that is to say, a half or a third. In 1922 about eighty-five per cent of the rates the railroads charged had to be collected by them so that they could pay their employes for their labor, the mines for their coal, their taxes, and so on. Actual running expenses thus ate up eighty-five cents out of every dollar the railway patron paid. The fifteen cents left were sufficient to pay only a trifle more than a four per cent return upon the value of the properties, out of which interest on debts and the rentals of leased lines had



Contrasting Units of Modern Transportation: A Giant Electric Locomotive Beside a Touring Car

In the Towering Mountains of the West Where Huge Electric Engines Whisk Freight and Passenger Trains over 650 Continuous Miles, the Power Being Supplied Mostly by Waterfalls

Dredging Sand from the Lake Bottom to Extend Shore Line; More than 1,500,000 Cubic Yards of Material Were Moved by the Illinois Central Railroad

to be paid before the stockholders got their share. Those fifteen cents of the dollar the railway patron paid were the only ones that could possibly have been affected by a change in valuation. If valuation had been cut a third, rates thus could have been cut one-third of fifteen cents, or five cents. This would have been a five per cent reduction, not the thirty-three and one-third per cent reduction which so many would have looked for who so mistakenly argued for reduction of a third in valuation.

Reviving railway credit made it possible for the railroads to put more than $1,700,000,000 into their properties in 1922 and 1923. The railroad with which I am connected, in the last twelve years has expended $225,000,000 in this kind of work, and this expenditure made it possible to carry our 1922 business for $21,341,652 less than would have been needed if we had been limited in 1922 to the facilities of 1910. Common sense has shown us that it pays to spend money to save money, and the railway patron who fully realizes the value of an efficient transportation plant undoubtedly must see the matter the same way.

But no matter how fine a railway plant we have, it will be hampered greatly in its operation if poorly manned and officered. More attention must constantly be given, I believe, to cultivating the morale of the employes and to making the work attractive to the best of our coming young men. The higher railway positions must be allowed to pay well if we are to keep our capable railway officials in railroading and if we are to keep a continuing supply of new officer material coming up through the ranks. I, for one, do not believe that railroading is less attractive today than it was twenty, thirty or forty years ago.

The young man coming along today is concerned only with his future and with what it is possible for him to do. Railway work, particularly in managerial matters, offers problems of diplomacy and of human relations which are peculiar to this age and which must be successfully solved if the progress of the railroads is to continue. I believe that our young men like difficult problems today as much as they ever did, and I believe that energy and talent will carry them as far in railroading as in any of the other lines of work open to them.

There are, of course, a great many capable men in railway management today—far too many, I believe, to allow the railroads to maintain rates that would stifle traffic. When the professional agitator of today talks about "restrictive rates" he is casting the worst kind of reflection upon the judgment of railway executives. Rates must be "just and reasonable," as provided by law, but they must be just and reasonable to the railroads first of all, if we are to continue to have a railway plant. The minute a rate threatens to cut down traffic—and that is the real test of unreasonableness as far as the patron is concerned—you can be sure that the railway executives themselves will be the first to advocate a change in that rate.

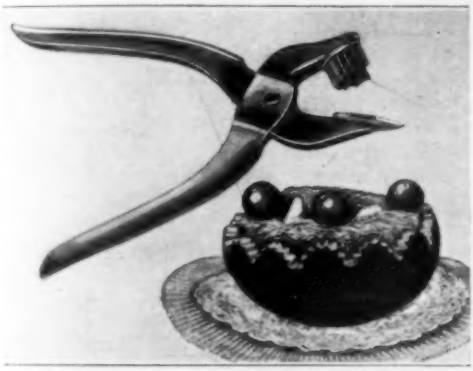
A great deal of poor logic has been put forth as arguments about the so-called guaranty of railway earnings. A guaranty which cannot be enforced is not a guaranty. In three years under the Transportation act, which contains this so-called guaranty, the railroads of the country failed by more than a billion dollars to earn the fair return to which they are supposed to be entitled under this act. The railroads have no way to get this billion dollars from the government, and they have no expectation of asking for it—so where is the guaranty about this?

FAMINE OF CONES SENDS BIRDS FROM NORTHERN WOODS

How the season governs the action of furred and feathered creatures in constant search for food was illustrated by a shortage of pine cones, the principal fare of birds and squirrels in the sub-arctic regions, due to the extended drought, last year. Thousands appeared early much farther south than they do in normal seasons. In their wake traveled the goshawk, or Arctic owl, evidently driven to prey on the small birds because of a shortage of mice and rabbits, its normal food. Red-breasted nuthatches were observed starting from their northern haunts in August and red squirrels appeared in great numbers in Vermont in search of the cones.

FRUIT CUTTER LIKE PLIERS STAMPS OUT DESIGNS

Scalloped edges are placed on grape fruit and orange halves for preparing



Fruit Cutter that Stamps Out Decorative Designs on Oranges and for Fancy Salads

"fancy" salads and other dishes with the aid of a pincer-shaped device. It has cutting blades shaped to stamp out a design with the precision of a die, and the leverage afforded by the spring handles makes the task easy. Fruit skins can be cut into basket handles and other fancy patterns that only a skilled person could achieve with an ordinary knife. It is made of durable metal, nickel plated, and the blades are strongly riveted to the handles.

Nearly 700,000 spiders would be required to produce a pound of web, according to estimates of scientists who have experimented with the substance as a substitute for silk. A single spider has been known to spin a thread 34,800 yards long.

STICK OF UMBRELLA AT ANGLE HOLDS TOP LEVEL IN RAIN

So the top of an umbrella can be kept level when raised in rains, a French concern has designed one having the handle

Umbrella with Handle at Angle to Keep Top Straight and Protect Carrier's Back

at an angle with the frame. During downpours the canopy of the article can be held centered over the carrier's body, equally protecting all sides. When the stick is rested over the shoulder, the cover does not tilt up in front and allow water to drip on the user. The arrangement is also said to give greater protection to the back of the owner.

OIL KEPT FROM SPARK PLUGS BY SHIELD OVER POINTS

To prevent oil fouling spark plugs, a metal shield that fits about the porcelain jacket within the plug and bends under the center electrode has been devised. It is attached by shaping two "ears" at the top to fit the curve of the jacket, and has a slot which slips over the ground electrode.

Spark Plug and Shield Designed to Prevent the Collection of Oil and Carbon

A broad extension bent up at the bottom acts as sort of an umbrella, to keep the oil spray from collecting.

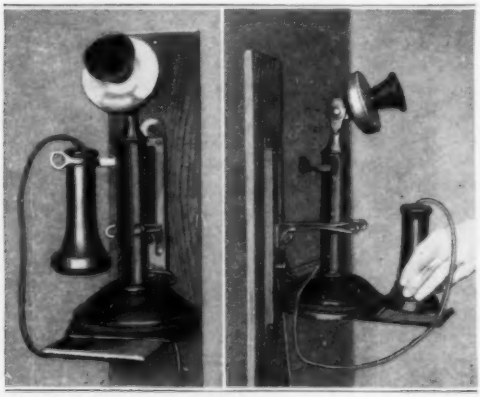
ELECTRIC PUMP AIDS DIPHTHERIA VICTIMS

Small Electric Pump for Cleaning Out the Throats of Those Afflicted with Diphtheria and which Is Credited with Saving Many Lives as Well as Relieving Intense Pain

Persons stricken with diphtheria are being relieved of its resulting painfulness by means of a small electrically operated pump which draws from the patient's throat the false membrane produced by inflammation. The instrument is credited with having saved many lives that otherwise would have succumbed to this contagious disease. The victim is stretched at full length on his back, while the operator manipulates the tiny device. It may also prevent poisons from entering the system.

TELEPHONE BRACKET ON SLIDE FITS HEIGHT OF USER

To fit the height of anyone using the telephone, a bracket has been devised by a western inventor that slides in a slot fixed to the wall. The instrument can be moved to almost any distance from the floor so that a person may stand or sit while talking. In case the receiver has to be set down before the call has been finished, it may be placed on a shelf that will lock in any of three different positions. When not needed, this ledge can be folded out of the way. The holder is said to eliminate much of the vibration and to give greater distinctness to the voice.



Sliding Telephone Bracket with Folding Shelf that Fits the Height of the User

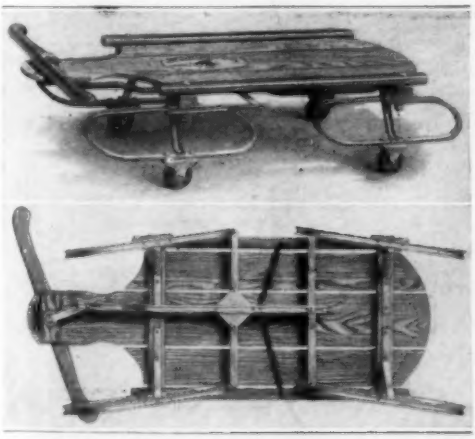
TESTS BY TIME AND FORCE AID SEARCH FOR BETTER HOMES

In testing building materials for strength, durability, and resistance to wear, the government bureau of standards uses huge pressing machines to crush concrete columns and steel beams by applying tremendous force to their ends. To learn the ability of hollow tiles to prevent passage of heat and cold, sections of walls are constructed of the material between a room artificially chilled and a warm chamber. Soundproofing substances are submitted to a trial by filling an opening in a thick wall with a section made of the matter. Noises are directed at the spot

and delicate instruments on the other side record any volume of sound that gets through. It has been found by the experimenters that a coating of aluminum or bronze paint applied to a surface will reduce the amount of heat radiating from it. In testing metal beams for structural work, a solid girder rolled from steel was proved to be equal to the ordinary article which is made up of several parts riveted together. Draperies, such as are employed for theater decorations, have been tried out for sound absorption, and interior linings for offices have been subjected to experiments to learn their worth in drowning the rattle of typewriters. More than seventy kinds of stucco are paneled on one long building, that is exposed to the weather over a period of years, to find which composition will successfully resist various climatic conditions.

"ROLLER SKATES" FIT ON SLED FOR ALL-YEAR COASTER

Detachable rubber-tired wheels, like those on the latest type of roller skates, that can be fitted in a few moments into the runners of a "coaster," convert the sled into a smooth and silent running wagon for seasons when there is no snow. Steering is done by a convenient front rod which simultaneously turns the forward

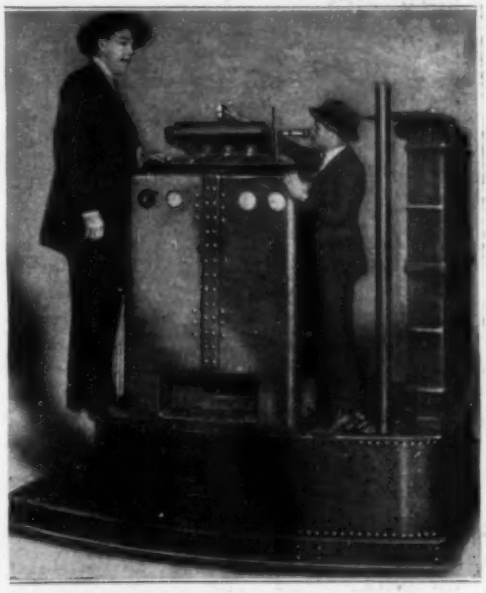


Side and Bottom Views of All-Year Coaster, Showing Rollers Attached and Steering Gear

and rear runners. Sharp corners can be managed in this way, the danger of "skidding" on steep hills is lessened and the sled is more easily controlled at high speeds. Springs and strong strips of steel are used in the gear and it is adjusted so that it cannot get "stuck." The sled weighs only fourteen pounds and is strongly built.

BABY STEAM GENERATOR GIVES TWO HUNDRED HORSEPOWER

Although only five feet in height, a high-pressure steam generator has been built in Cleveland, Ohio, that is capable of

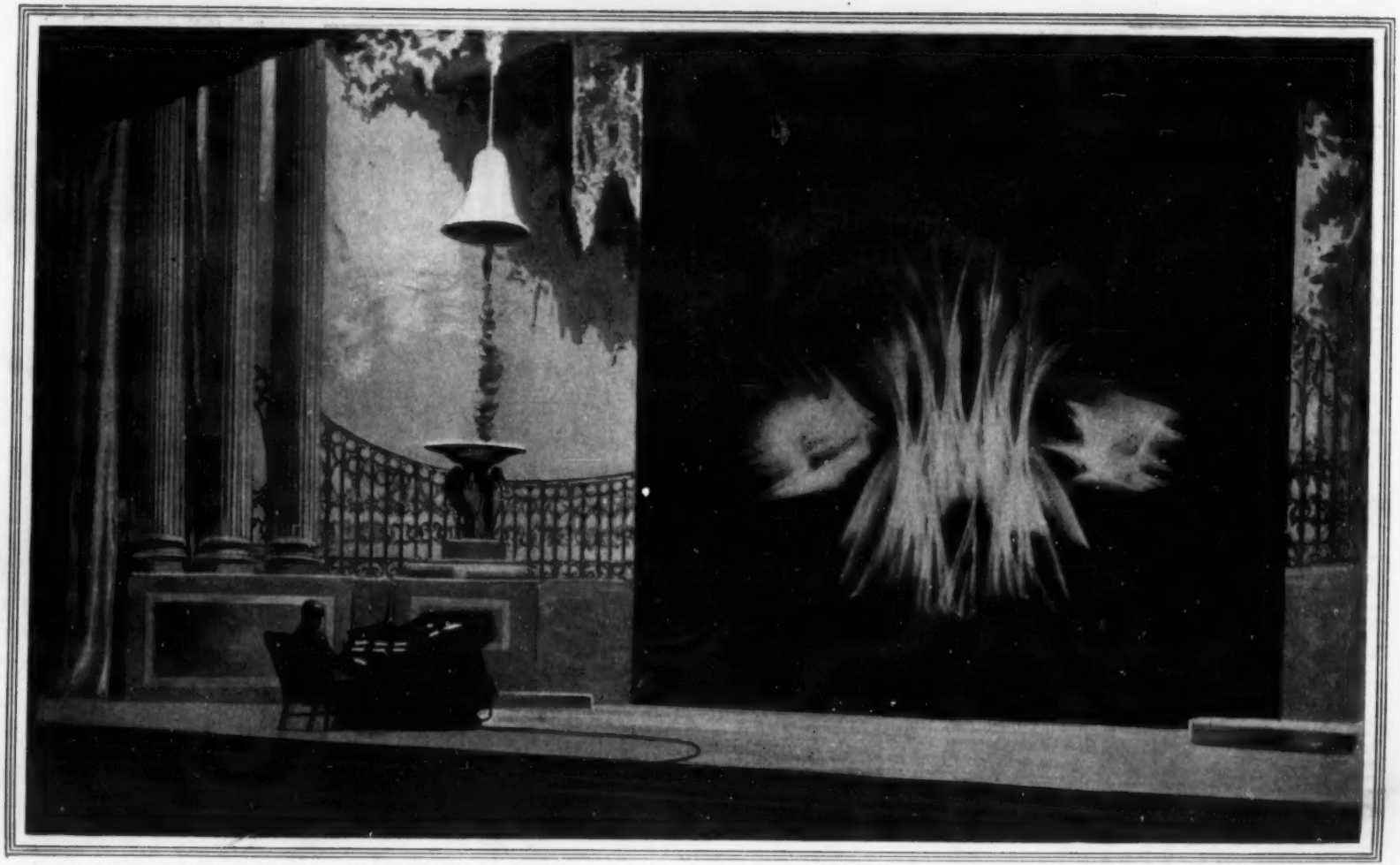


Midget, High-Pressure Steam Generator Beside Movie Giant, Who Is Eight Feet Nine Inches Tall

delivering 200 horsepower and of exerting 2,000 pounds pressure to the square inch. The military rights are controlled by the war department and a locomotive company using it is said to be making engines that are designed to run from New York to Chicago without a stop.

SKELETON OF THE GIANT SLOTH FOUND IN WILDS OF BRAZIL

Petrified bones of the giant sloth, a creature now extinct, were found by Dr. Oliver C. Farrington, of the Field Museum of Natural History, after a 700-mile expedition into the interior of Brazil. The skull was discovered near a water hole, and other bones in a wall that the natives had erected to keep animals from the water. The precious fragments, for which continents had been scoured, had been fitted into the barricade in the belief that they were "just rocks." The skeleton is to be restored, the small bones, which could not be found, being molded of plaster. The sloth lived thousands of years ago. It was about ten feet long, six feet tall, and ate leaves from the lower branches of the trees by stretching out its long neck.



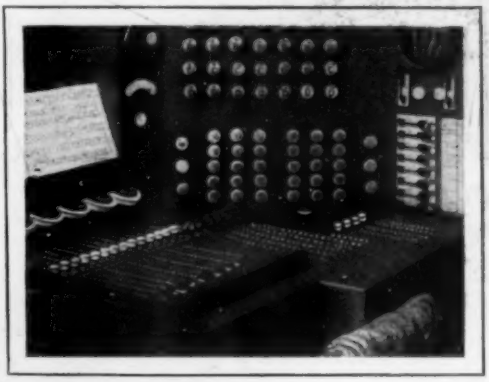
One of the Thousand or More Color Forms, Constantly Changing in Tone and in Hue, and the "Organ" with Which They Are Projected on Screen Before Audience at the Touch of an Artist upon Its Keys; the Result Has Been Hailed as the Creation of a New Art

Music Is Turned Into Glowing Color

Soundless Symphonies from Keys of "Organ" Projected on Screen Are Hailed as Birth of a New Art

THE audience sat in hushed and wondering expectancy within the darkened theater. Without accompaniment of sound, soft color suddenly glowed upon the screen. Slowly it moved into definite form, its modulation of figures evolving in majestic sweeps. Its hue deepened and then melted radiantly into iridescent crimson, and from the restless, ever-changing shapes a slow rhythm was born. It grew and blossomed, a symphony of light, plastic and mobile. The "clavilux," as Thomas Wilfred, the inventor, has named the organ, opens the door to a new art, the expression of moving color and form, which the artist-craftsman believes is destined to take a place as a sister of music and sculpture. It has long been the vision of dreamers; Mr. Wilfred has actualized the dream and provided the instrument that visualizes it.

The idea of the "art of light," according to the inventor, had its inception in the mystic rites of prehistoric man. The caveman, he notes, used to weave magic spells over his tribe by flourishing firebrands in weird combinations about a campfire. And in ancient China chemicals were used to make fires of striking colors at religious ceremonies. "Sound," he says, "was harnessed and placed at the command of a skilled player at a keyboard centuries ago.



Light has had to wait for the electrical and optical developments of the last twenty years; but the young art of light has greater possibilities than any other art form, because its medium is the greatest power in the universe, the source of all life."

It was during his boyhood in Denmark that the inventor began experimenting with light, making rainbows on the walls with prisms pilfered from the chandelier. Later he learned to project light forms from a cigar box; and finally the finished product of his boyish experiments appeared in the steel instrument on which he now performs.

The clavilux has three manuals and a triple light chamber, corresponding respectively to the keyboard and wind chest of the pipe organ. Disk keys appear on the manual, moving to and from the operator and playing color and form almost as the pipe organ plays sound.

There are 100 positions for each key, making possible almost infinite combinations of color and form. The "music," or

Color Combinations Produced with a "Clavilux" and a View of One Section of Its Keyboard

notation, is printed in figures upon a five-lined staff, three staves joined, as treble and bass clefs are joined for piano, to provide a "clef" for each of the three manuals. A color chord is represented by three figures; as, for example, "40-35-60"; and movement of the prescribed keys to the designated positions on the numbered scale of the keyboard produces the desired figure.

The artist sits at the keyboard with the notation book before him. He releases the light by means of switches. By playing upon the keys he projects it upon the screen, molds it into form, makes the form move and change in rhythm, introduces texture and depth, and finally injects color of perfect purity in any degree of intensity.

The light is concentrated into a beam which is projected through a form-producing device for depth and texture, then filtered through colored screens. And then in a darkened hall, through the three-dimensional projection of the "color organ," the light pours from lenses at the back of the instrument and the flat white screen "is made a window into space where fluid light-forms are built up in fantastic compositions. The result on seeing it for the first time is the same as if music had never existed and one were suddenly to hear the strains of a violin. What would the reaction be? The listener would say: 'Yes, this is nice, but of what use is it?'" the inventor declared.

Inventor at Keyboard and a Color Symphony

"Light music is as much an art as painting, sculpture or dancing. It can be used in the theater to intensify the emotions of the actors, or to supply what music does to the movies. Light, which is the source of all life, is a wonderful medium for artistic expression. In light compositions we aim at the abstract. We have no picture of a rose or a sunset; but, instead, the glory of the sunset, the spirit of the rose.

"I confidently predict that a few years will place 'light concerts' beside symphony concerts, the opera and the movies. And every home will have a color organ, as every home now has a piano or a phonograph."

"The first screen of verdant jets, warming into waving sheaves, was suggestive of the coming of spring," says a critic in recording his reactions at a color recital; "and that was emphasized by the gorgeous colors of a tulip.

"The second composition took us into heaven with the imitation of an eagle's soaring, and pictured the beauties that could be viewed from its eerie height, —a fantasy in ethereal realism. The next composition was richer and more complex. The unique feature introduced here was the changing of the background either to harmonize or to contrast with the formative colorings that played upon it. It was suggestive of the pomp and glory of the earth's most magnificent royal courts.

"The colors brought dreams and distant visions with them, shifting and changing constantly as the artist touches the keys."

PLANT BREEDING TO INCREASE WORLD'S FOOD SUPPLY

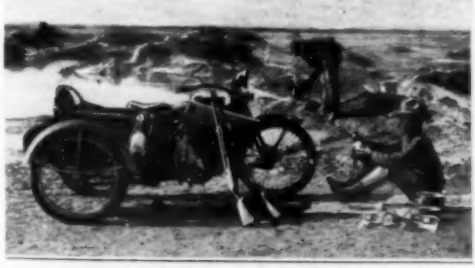
Selection and proper breeding of plants may increase the world's food supply more than 25 per cent, according to scientists. New kinds of growths that resist diseases of vegetation may be developed and others graded to suit various climates and conditions of the soil. Intense study and tests by actually raising and crossing the different types of crop plants, it is believed, may result in creating species heretofore undreamed of.

DOUBLE-STRAND WHEEL CHAIN ADDS TO AUTO TRACTION

Double strands across the tires in an automobile wheel chain of recent design are said to increase the traction and add to length of life and the strength of the device. When the wheels start to spin, one of the cross lengths is forced on top of the other, thus affording a better hold. Otherwise, they lie side by side and travel as smoothly as a single strand. The chains are attached with a safety hook on the side.

MEALS COOKED WITHOUT FIRE AMONG VOLCANO FIELDS

On the east shore of the Salton sea, in the Colorado desert, there is a vast field of natural mud volcanoes, spouting geysers



Duck Hunters Preparing a Meal in Their Camp Among the Volcano Fields near the Salton Sea

and holes in the ground, known as fumaroles, from which jets of live steam issue with terrific force. During the fall and winter months, the spot is the rendezvous of unnumbered thousands of migrant waterfowl, which makes it popular with hunters. Wood for camp fires and cooking purposes is almost totally lacking, but it is not needed as the live steam of the fumaroles supplies heat for all purposes.

TIES BABY BUGGY ON CANE TO REPLACE PUSHCART

Fitted on the end of a walking stick, a small baby carriage has been invented by a father who got tired of using the ordi-

Baby Carriage Attached to End of Walking Stick that Folds Flat When Not in Use

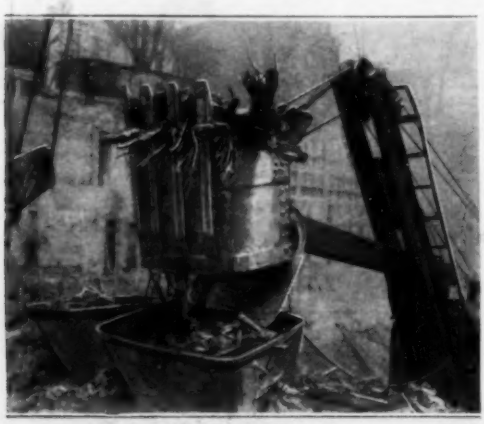
nary pushcart. When not in use, the carriage folds up flat so that it can be carried readily. It runs on two wheels, the fabric being stretched over a collapsible frame.

WATER SAVED FROM BURNT GAS IS BALLAST FOR AIRSHIP

By condensing the exhaust gas from burning gasoline in airship engines and storing it as water in the ballast, loss in weight is prevented. This results in the saving of many thousands of dollars' worth of expensive helium gas that lifts the craft, and which otherwise would have to be released and wasted to keep the ship from rising to dangerous heights. A device for this purpose has been perfected and with its aid, the cruising radius of dirigibles is expected to be increased greatly. The weight of the water from the exhaust vapors more than equals that of the gasoline, which requires more than three times its weight in oxygen for proper combustion. More than one-third of this amount of the oxygen is formed into water to serve as ballast for the ship.

EIGHT CARTLOADS AT ONE BITE TAKEN BY ELECTRIC SHOVEL

Run by one man, an electric shovel has been made that will take eight dump cartloads at a bite every minute. In less than four working days it can handle material equal in cubic contents to the Washington monument. Because of the great boulders and hidden roots with which they have to contend, these shovels must be able to exert a tremendous force, and yet they are so easily controlled that an expert operator can break the crystal of a watch with the bucket without other injury to the time-piece. In deep excavations, strange objects often are uncovered. Fossils, bits of some previous civilization and even skeletons are sometimes found. Only a few months ago, a steam shovel disclosed a skeleton, presumably that of an Indian who was believed to have perished in the Fort Dearborn massacre more than a hundred years ago.



Powerful Electric Shovel that Was Victor in Struggle to Dislodge Stubborn Tree Roots

AUTOS CHANGE OSTRICH PLUME STYLE IN WOMEN'S HATS

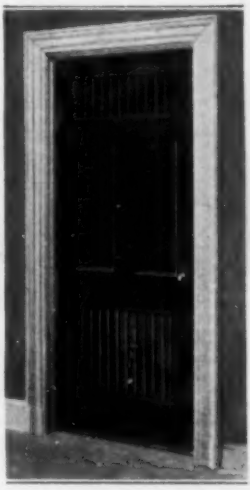
Styles in women's hats are not wholly born of the whims and caprices of fashion, but often are due to the dictates of necessity, according to milliners. For instance, the single ostrich plume, it is said, is being discarded largely because women have found that its shape and beauty are damaged by the winds and storms encountered while riding in open automobiles. The large plume is, therefore, being replaced with smaller ones and with decorations woven from the feathers. In some cases, these are covered with a fine gauze-like material to prevent their being damaged. The increasing number of closed cars also is said to favor the use of the smaller plumes, and several large millinery establishments report increasing sales of them. Most of the plumes are exported from South Africa, and reports from breeders there indicate that the industry, which was seriously damaged by the war, is recovering.

GOLDEN GATE BRIDGE PLANNED WITH TOWERS AND LIFTS

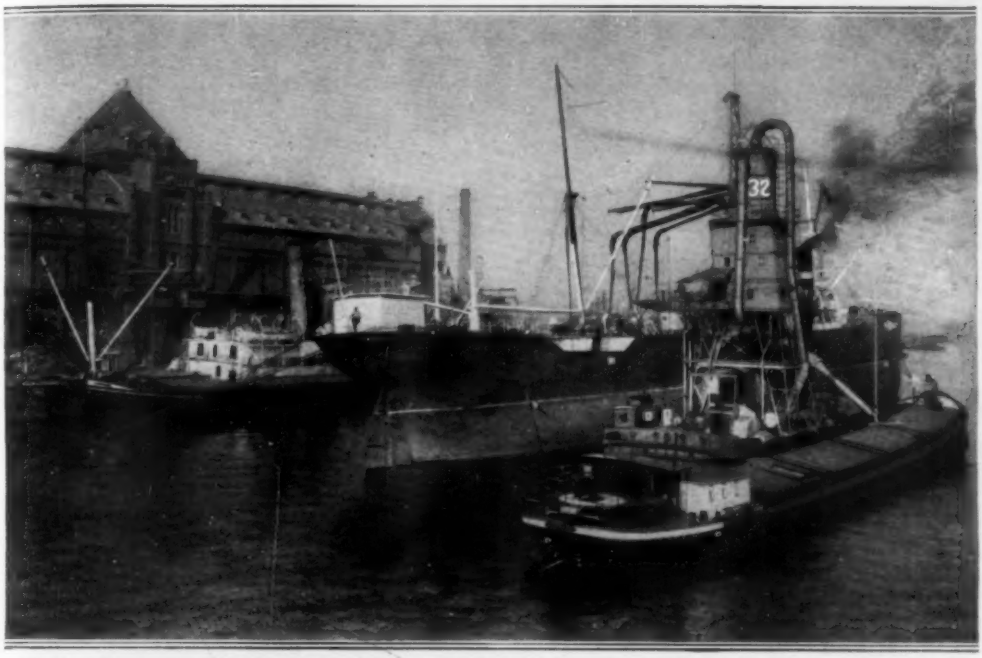
Spanning a distance of over a mile and a half, a giant bridge planned to cross the Golden Gate at the entrance to San Francisco bay, will combine both the suspension and cantilever ideas. Steel towers rising from the rock shelves lying near shore will reach a height of 950 feet from the bottom. The roadway will be 200 feet above the water, thus permitting the passage of ocean craft having tall masts. The middle span will be almost a mile in length. It is said that the structure is to accommodate two trolley lines, an automobile passageway in each direction, and two sidewalks. Platforms are to be built at the tops of the towers for observation purposes and will be reached by elevators.

VENTILATORS IN STEEL DOORS DO AWAY WITH TRANSOMS

Steel doors with adjustable, built-in ventilators, to replace the usual transom, have been designed for use in public buildings such as hotels and hospitals. The size of the opening at the top is regulated by a handle conveniently located on the inside. Drafts are avoided with this arrangement and greater privacy and safety are assured, as no entrance can be gained to the room over the top of the door. The movable parts are tightly fitted to prevent rattling. The pressed steel surfaces are enameled, or grained to resemble wood. The invention simplifies carpenter work in building and saves the cost of glass.

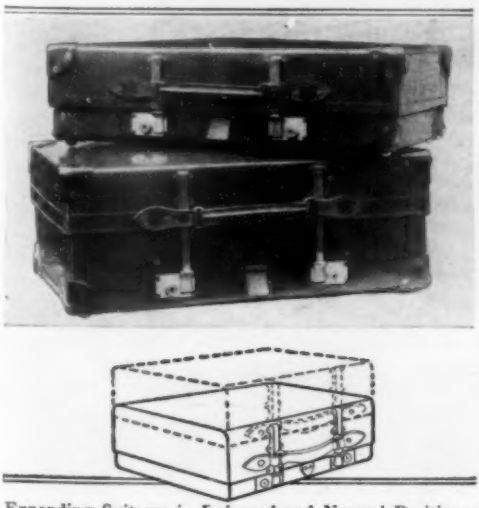


FLOATING ELEVATOR HANDLES CARGOES QUICKLY



Floating Elevator for Handling the Grain Cargoes of Ships in Harbors too Shallow for Them to Approach the Docks; Suction Pumps Transfer the Wheat to Barges

To load and unload grain-carrying ships in shallow harbors of Holland, where the big boats can not approach the storage docks, seagoing elevators have been constructed that meet them in deep water to make transfers of the cargoes. Anchored alongside the steamer, the bargelike structure draws the material from the holds by means of pumps and chutes and deposits it in great bins. The operation is said to take no more time than is required by an ordinary land elevator, and the floating type can also be used for storage where necessity demands.

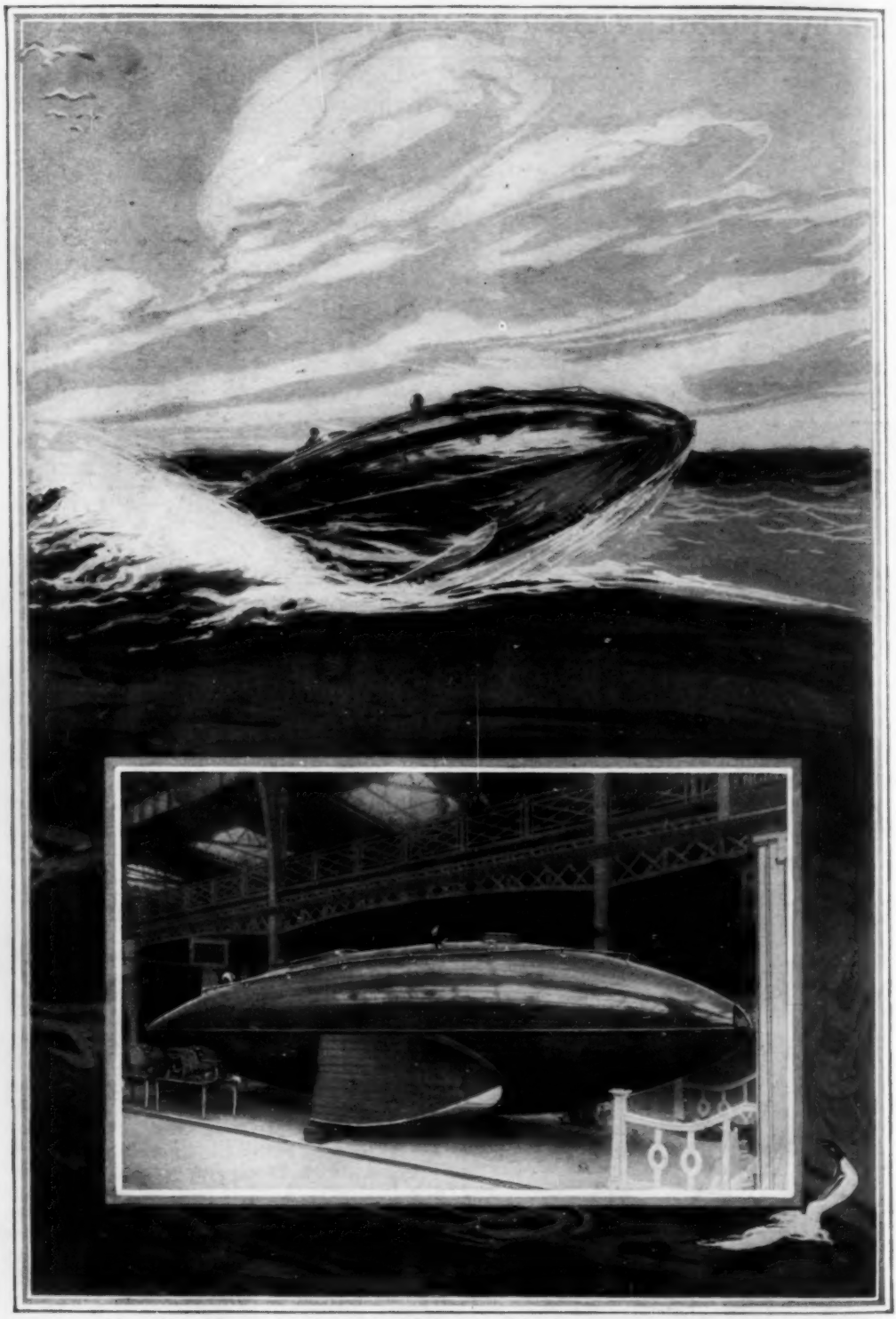


Expanding Suitcase in Enlarged and Normal Positions: Drawing Illustrates Extension Hinge Arrangement

EXPANDING SUITCASE CARRIES SLIGHT OR BULKY LOADS

Designed to hold loads of varying size and to eliminate the difficult task of closing the lids on tightly packed and bulging baggage, an adjustable suitcase has been put on the market by an English inventor. Its hinges are arranged so that a brass-rod extension on one is made to slip into the other as a holder. The top can be raised or lowered to fit loads of different bulk. It is locked securely when the top is pressed down firmly on the contents in the bottom. Also, it can be adapted for week-end, or longer visits, and frequently makes a trunk unnecessary.

¶Write our Bureau of Information, if you wish to know who makes or sells any article described in this magazine. Send no postage; the service is free.



Mile-a-Minute Speed Boat that Is Built Like an Airship, the Hull Being Driven over the Waves by an Eighteen-Cylinder Gas Engine Developing over Four Hundred Horsepower

SPEED BOAT LIKE AIRSHIP TRAVELS MILE A MINUTE

To make over 60 miles an hour, a boat, shaped like the gas bag of a dirigible airship, has been patented in England. It is said that the model can be adapted to either a superspeed cruiser or a hydroplane. The hull consists of a mahogany "skin" two inches thick, built over circular steel ribs, any of which can be separately removed and renewed. When racing, the craft will be almost entirely out of the water. As its weight is less than one-third that of ordinary

View through the Hull of Speed Boat that Is Built over Circular Steel Ribs and Is Two Inches Thick

shells of similar sizes, the vessel can house an engine heavier and more powerful than ordinary types of power racing boats, thus making greater speed, with less resistance from the water. Energy is generated by a 450-horsepower gasoline motor of 18 cylinders. For extreme speeds detachable blades can be placed along the sides. These wings, resembling horizontal rudders, force the hull out of the water and assist it in skimming over the waves.

NAVY FLIERS TO CHART FRIGID PATH TO THE NORTH POLE

Extensive preparations are being made by the United States navy for the air expedition which is to chart the north polar regions for an air route from Western Europe to Japan by way of Spitzbergen and Nome, Alaska. Two ships, six airplanes, and mooring masts for the Shenandoah, the giant dirigible, are included in the equipment. The flight is attempted, not for the purpose of making a dash to the pole, but to survey the entire arctic area, covering 1,000,000 square miles, a territory yet unexplored and, in extent, equal to nearly one-third of the United States. The expedition will go to Nome to establish a base, and to Spitzbergen, where preliminary surveys will be made. When preparations have been completed, the Shenandoah will follow, leaving Lakehurst, N. J., and sailing by stages, first to Fort Worth, Texas, thence to San Diego, California, Puget Sound, and to Nome by way of Seward and the west coast of Alaska. There the dirigible will be anchored to the mooring mast already erected by the vanguard of the expedition, and cruises will be made into the polar regions. The first summer's work, it is planned, will be devoted to reconnaissance and to the establishment of bases.

DEER INCREASING IN NUMBERS IN NATIONAL FORESTS

Stricter enforcement of the game laws, and better food supplies in the United States national forests, have proved so beneficial to herds of deer that it is estimated that 441,000 of the animals now make their homes within these protected boundaries. California alone has 185,000 of the animals in its national forests; Oregon is next with 57,000, Montana third with 41,000, and Idaho fourth with 39,000. In the Kaibab National Forest, of Arizona, is a herd of 20,000 deer and their numbers are annually increasing, as no hunting is allowed. Other game also has found sanctuary within the limits guarded by the rangers and wardens who keep vigilant patrols throughout the year.

NUMBERS ON TICKETS PREVENT JAMS AT BUS STOPS

To keep waiting passengers in line according to the time of their arrival at automobile-bus stations in Paris during

"First-Come-First-Served" Ticket Stand on Street Rack that Prevents Motor-Bus Jams

rush-hour periods, every patron takes a numbered ticket from a rack attached to a pole. The cards are made up in pads and are perforated so they can be easily torn off. Each holder contains separate tabs for the different routes. Guards do not permit persons holding higher numbers than any one behind them to enter the coaches out of turn. This system of "first come, first served" is said to insure discipline among the crowds and to eliminate rushing for seats when the bus stops. Once aboard, the passenger discards the ticket.

NON-AGING PAINT WON'T TURN FROM WHITE TO YELLOW

Yellowing of white-enameled woodwork is expected to become a thing of the past as the result of experiments at Lehigh University in search of a process whereby paint may be made to retain its original color value for a much longer period than has heretofore been thought possible. The changes, it is stated, have been due to the pigments used. Under the new process linseed oil is bleached until it is nearly colorless before mixing it with the other ingredients. It was at first thought that the discolorations in white paint were due to the chemical changes, but the tests are said to have proved that the change resulted from the linseed oil gradually coming to the surface after the paint or enamel had dried. The bleaching process in no way works harm to the valuable properties of the oil, it is declared.

ALARM ON DRIP PAN TO KEEP WATER FROM OVERFLOWING

Damage and inconvenience caused by the overflow of drip pans underneath the refrigerator are avoided with the aid of an electric signal which fits on the side of the pan and rings automatically when the water is within an inch of the top. A float, resting on the surface and attached to the signal, is pressed upward as the basin fills from the melting ice. At a certain height, a connection is formed which starts the bell ringing to announce that the pan needs emptying. The alarm is simple to attach and does not interfere with the pan sliding under the refrigerator.

BOLT IN BARREL OF PADLOCK DEFIES ROUGH TREATMENT

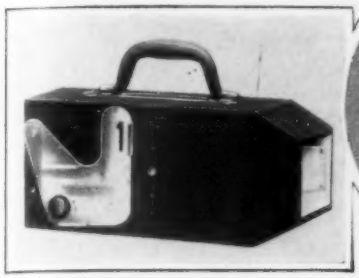
Made of two solid pieces of steel, a padlock is secured with a patented bolt that slips into the casing of the lock. It is claimed that the hold is so positive that it cannot be picked or broken. By turning

Padlock that Is Locked with Bolt that Is Inserted into Its Solid Steel Casing

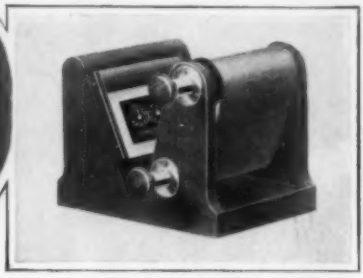
the shackle around and inserting the bolt through the end remaining in the casing, the padlock may be left open.

CAMERA FOR METERS TAKES PHOTO OF DIALS

Errors in reading gas, electric and water meters are largely eliminated with the use of a camera that makes photographic records of the dials from which the bills are computed, instead of the notations of readers. tomer before them when making out monthly statements. The machine fits directly over the meter dials. Pressure on a lever exposes the film, opens and closes the shutter and turns on four electric lamps to fur-



Meter Camera Showing Shutter Lever



Film Spool: Left, Camera and Negative

The camera furnishes clerks with actual pictures so that they have, practically, the meter of each cus- nish light for the picture. The current is supplied by dry batteries. Film for 225 readings can be carried.

"TEN-SECOND" RAZOR HONE FITS STRAIGHT OR SAFETY BLADES

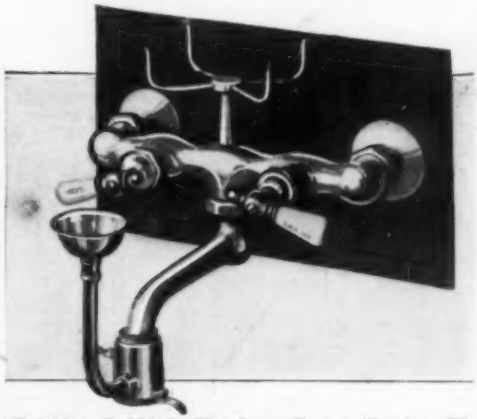
Concave on one side to fit safety-razor blades and flat on the other for straight edges, a dry hone is being made to sharpen quickly and satisfactorily any kind of a razor. A gentle, sidewise movement of the blade on the surface of the sharpener, which is composed of a special abrasive material, will produce a shaving edge in ten seconds, it is said. The hone is made in convenient size and shape.

LIQUID OXYGEN FOR BLASTING SUCCESSFUL IN TESTS

Cartridges of gas black and wood pulp soaked in liquid oxygen have been used successfully for blasting mine drifts, shattering a 200-ton cliff and for uprooting trees in Colorado. The tests were made by the department of the interior. The oxygen was shipped in an automobile in flasks built like thermos bottles. The cartridges were set off with instantaneous electric detonators or with cap and fuse, and no misfires occurred. Further experiments are being conducted.

DRINKING FOUNTAIN ON FAUCET ALSO WASHES BOTTLES

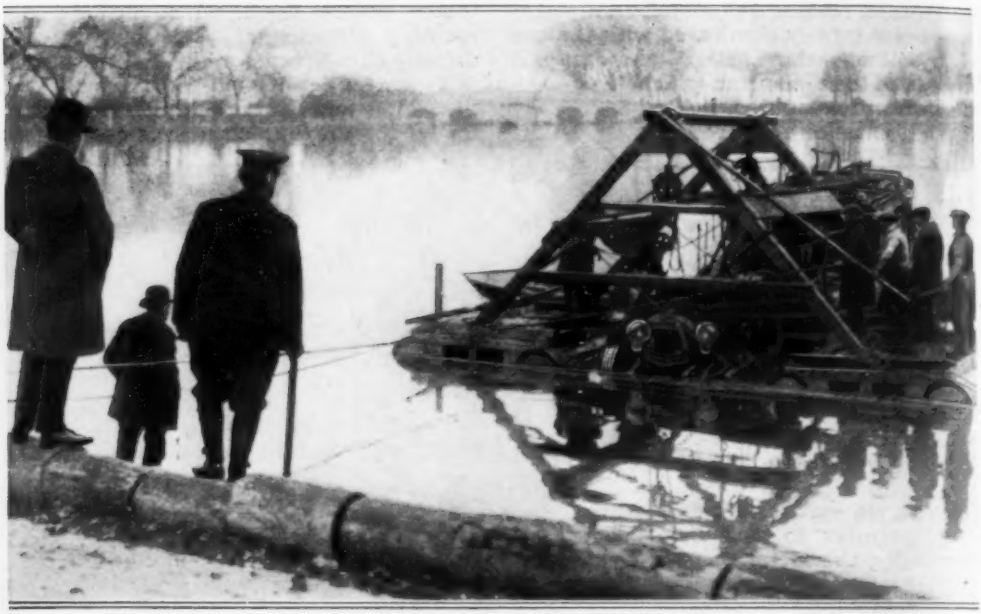
Drinking from a washbowl faucet is possible with a convenient fountain attachment that slips on the ends of the hot and cold-water nozzles. It is fitted with a filter to strain the water and the bowl is so shaped that bottles are thoroughly cleansed and rinsed by inverting them over the stream that is shot from the top. Water is released into the bowl by open-



"Drinking Bubbler" Fitted on Faucet Nozzle: The Trap Release Is Seen at Bottom

ing a spring trap at the bottom of the "bubbler." The fitting is nickel-plated and adds to the attractiveness of the bathroom.

RAISE SUNKEN AUTO WITH TACKLE ON BARGES

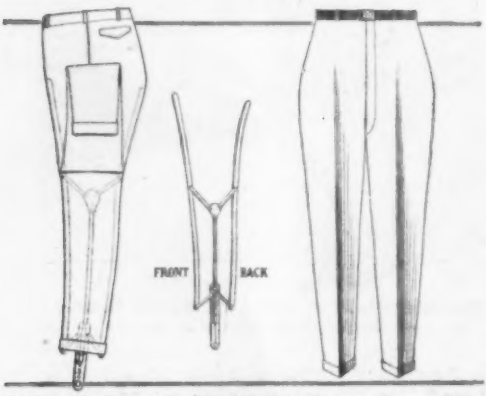


Revenue Agents Supervising the Raising of Sunken Automobile Which Was Thought to Contain Contraband Liquor; Right, Preparing to Float the Car Ashore on the Barge-Lifting Derrick

To raise an automobile which had plunged into the waters of the tidal basin in Washington, D. C., tackle was rigged to a triangular derrick anchored on two short barges. The apparatus was placed directly above the machine which was visible in the clear waters below. After chains had been attached to it with grappling hooks, the car was raised with little difficulty and was floated ashore. A small power boat was used to tow the car and the lifting machinery.

CREASER IN EACH TROUSER LEG ELIMINATES "BAGGY KNEES"

Sharp, straight creases are kept in trousers and "baggy knees" are eliminated by the use of a pair of collapsible stretchers that fit inside each leg. The wires are shaped in front and back to fit the contour, and can be adjusted tightly or loosely as desired. They are about sixteen inches long when folded, occupy but little space in a suitcase or bag, and are adjusted in a moment's time.



Collapsible Stretcher Fitted Inside Trouser Leg to Hold a Sharp, Smooth Crease

PAPER USED IN PIPING WATER TO WITHSTAND PRESSURE

Paper piping for water under pressure has been designed by a French inventor who proposes to build it upon a commercial scale. The paper or light pasteboard is wound upon the shaft of a machine embodying a tank containing an adhesive substance. The last three layers are impregnated with tar, and, finally, the pipe is given a covering of bitumen. An enlarged diameter is provided at one end, into which is fitted the smaller end of the succeeding section, and the joint is wound with a strip of tarred fabric.

Prosperity Ahead for the Farmer

By ARTHUR CAPPER
United States Senator from Kansas
(Copyright, 1924)

I AM inclined to be optimistic over the future of American agriculture, despite the troubles which the business has encountered in the last four years. Conditions are improving, slowly but surely. We are far enough along in the readjustment period so we can see the sunrise of economic hope faintly in the east. By this time next year the rays should be much brighter.

This improvement is being brought about by the operation of powerful forces which are slowly getting production in line with what the markets of the world demand. They are operating in several ways. For one thing, the number of producers is being reduced. About 650,000 folks left the farms in 1923, probably a half million in 1922, and it is believed that a half million or more will go in 1924. Please remember that there is a double action for every one who leaves; production is decreased by one unit, and one person is added to the consumer class.

Those who remain are going in more for types of production especially adapted to the locality in which they live. Especially has there been a growth of diversified farming in the one-crop regions. Producers are getting away from the old plan of "putting all of their eggs in one basket." In the great wheat-growing regions of central Kansas, for example, I found last summer a most encouraging interest in dairying, poultry raising and livestock farming in general. In some sections, along the Arkansas river, for instance, farmers are turning their attention more and more to truck farming, which has been fairly profitable in many communities. All this is

an indication of the effort producers are making to bring their production in line with the requirements of the city trade.

Along with this is the same intelligent effort to adopt selling methods which are modern, and more satisfactory than the old "dumping" plans of the past. The growth of co-operative commodity marketing is one of the most encouraging items in the economic progress of American agriculture. Producers are working together to handle their products in a way they have never done before, especially in tobacco, cotton, wool and with California fruits. I think the effort which is now being made to organize the wheat farmers is a movement that has much promise of success, and that it will in time get the production of our great bread crop on a profitable basis.

I mention these things to show that the producers are trying to place their house in order. Other factors have helped, including Congress, which has passed some legislation, especially along rural credit and marketing lines, which will aid greatly in the fight toward prosperity. Another thing that will help will be the growth of a powerful industrial life in America, which will increase the home demands for food. I am very optimistic over the future of the industrial life of this country. I believe it will continue to develop, aided by the intelligence and the ambition of the workingmen, and the extraordinary use of machinery, into a prosperity we have never before known. This is of vast importance to farmers, for the city workers who have money can always be depended on to buy an ample supply of food of good quality.

The main thing for a man who is thinking of taking up agriculture as a vocation to consider is the long-range view of the business. He should enter it with a knowledge of the tendencies of the times, especially those of intelligent production, adapted to the section in which one lives, and co-operative commodity marketing. The man, or woman, who likes the life of the open fields, and who goes into the business of farming with his mind full of hope and a vision of what the coming days will bring is likely to succeed. And he probably will live a more satisfactory life, and raise happier children, than ever would be possible in an overcrowded city.

It seems to me that the opportunity for a better home life is one of the great advantages of the coun-

try. The surroundings of the rural home are more likely to be wholesome than those in the city. At least one has more of an opportunity to control them.

If a man has an ambition to live in the country a big thing to consider is the need for caution in locating. Take plenty of time, months if necessary, before deciding on either the community or the farm. Get out into the open fields, and work for some farmer who is above the average in financial success if possible. Absorb his viewpoint, and that of any of his friends you encounter.

A man who goes at the proposition slowly is likely to make the minimum number of mistakes, and to settle in a neighborhood in which he will do well financially, and live a more satisfactory life than the city can ever offer.

ELECTRIC FURNACE FOR GLASS GIVES CONTROL OF HEAT

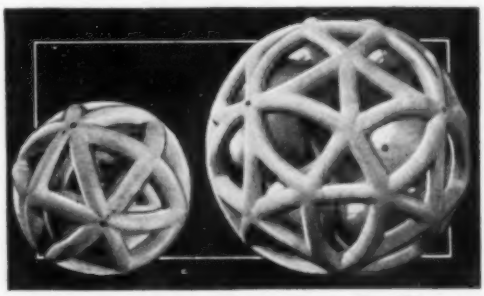
Adapted to heating various metals to 1,300 degrees Centigrade, an electric furnace has been designed by a Swedish engineer. Because of an efficient system of temperature and current controls, it is said to be practical in the manufacture of uncolored window glass. The furnace was tested for six weeks in a large factory and the results are said to have been satisfactory. Gas has been used generally in the glass industry, as it develops a high temperature and is easily regulated.

BATTLE TO PREVENT ANTELOPE FROM BEING WIPED OUT

To prevent the threatened extinction of prong-horned antelope, a large tract of land in Oregon is to be used as a refuge. The necessity for this action is shown by recent statistics in which the number of these animals in the United States today is estimated at 22,000. In the pioneer days of the west, however, antelope were even more numerous than buffalo, numbering approximately seventy-five million.

TWO BALLS CARVED OF WOOD INSIDE THIRD SPHERE

After months of effort, a wood carver has completed a ball, two and one-half inches in diameter, inside of which there is another sphere, one and seven-eighths inches wide. In the center of the latter there is a third ball. In another ball the same artist carved six smaller spheres, requiring four months to complete the task. Only a single block of wood was used in both cases.



Balls Carved from Single Block of Wood with Other Spheres Inside of Them

Cleaning Beautiful Statues in Versailles Gardens with Steam from Hose

STEAM RESTORES BEAUTY TO FAMOUS STATUES

To clean the dirt of generations from the statues in the Gardens of Versailles, in France, and to enable experts to repair and restore them, a steam outfit, with hose and a flattened nozzle, has been employed. By this means encrusted deposits, almost as hard as the marble and bronze, were removed without injury to the surface below, bringing out, in clear relief, the beauty that has been the pride of French rulers from the time of Louis XIII. From their pedestals, these statues have looked down on the historical events of modern times, for it was in these gardens that the storm of the revolution broke, and two treaties, one ending the Franco-Prussian War, and the other ushering in the armistice, were signed near by.

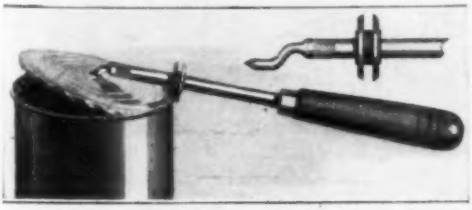
LOCOMOTIVES ARE SENT ACROSS SEA ON SHIP'S DECK

To save time and labor usually devoted to erecting new railroad engines at their destinations, a consignment of locomotives prepared for operation, were shipped by steamer from England to India recently. Huge hydraulic cranes lifted the iron monsters, intact, to the ship's deck, where they were covered for protection, and blocked against rolling by special tackle arrangements. Each was fitted with a sling designed so that it could be quickly taken from the boat. On being landed, the locomotives were put directly into service without the delay of passing through an erecting shop. This method, it is said, resulted in a great saving of material and labor that has been usually required to tear down and crate the engines and stow them in the hold.

Locomotives Ready to Run, Loaded on the Deck of Steamship for Transportation Overseas

ROLL CUTTER ON CAN OPENER LEAVES SMOOTH EDGES

Danger of cutting the hands in opening tin cans is eliminated by a safety opener that bends the rough edges downward as it cuts. It has a sharp, nail-like point on the end of a short steel bar that is punched through the center of the can top and is curved to fit firmly under the tin. A grooved cutting wheel, that slides on the bar, fits over the rim of the can and slices the top as it is turned. The groove keeps the wheel from slipping off and strong leverage is easily exerted on the handle. The wheel may be reversed when the inside edge becomes dull. The cutter will fit cans of various sizes and may be used also for taking corks out of bottles.



Can Opener that Eliminates All Danger of Cutting the Hands on Rough Edges

SUGAR AIDS SOAP IN CLEANING

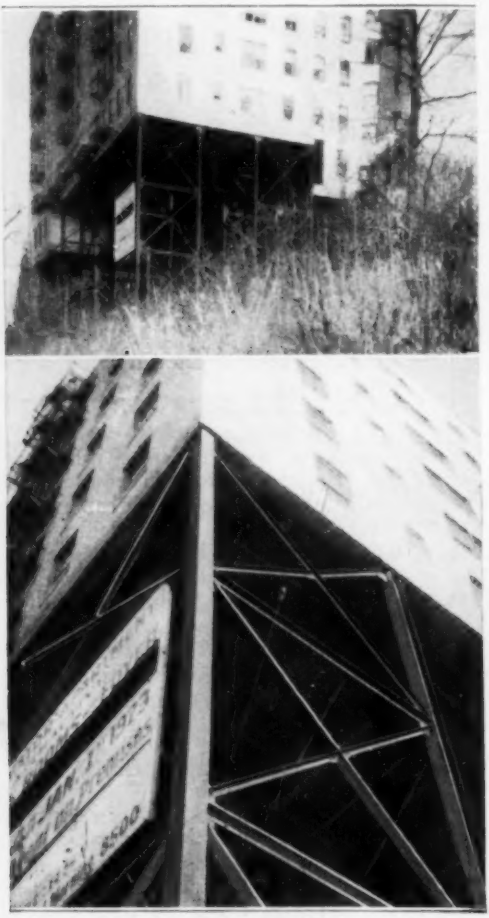
Unusual cleansing qualities and less damage to fabrics, are claimed for a soap largely made of sugar. The manufacturer asserts that the alkali, commonly mixed with fatty oils and acids to obtain the lathering reaction, is injurious.

NEVER-ENDING PANAMA VIGIL KEEPS CANAL OPEN

Drills and dredges and numbers of workmen have been kept busy ever since the Panama Canal was opened to commercial navigation ten years ago, in removing tons of earth that occasionally slip into the passage in the steep cuts, and in widening the channel in places. To loosen the cliffs and break up the fallen material so that it can be handled easily, charges of dynamite are exploded and powerful machinery speeds the removal of debris, so that shipping will be tied up as short a time as possible. In one slide not long ago, nearly 500,000 cubic yards of earth fell into the canal, and shortly after its completion, the passage was closed to traffic for several months until it could be safely cleared again. Dredges are kept ready for instant service, whenever the slides occur, and, while steamers ply through the channel, workers are still engaged in digging operations such as were employed in original excavations, to make the canal wider at various turns and sharp points.

SIX-STORY BUILDING IS BUILT UPON "STILTS" OF STEEL

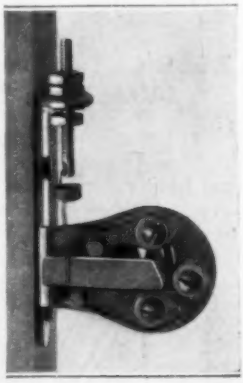
Resting on a framework of steel, instead of the usual stone or brick foundation, a six-story apartment building on a steep hillside in New York presents a unique appearance. Engineers calculated that the cost of brick or similar material, for high walls necessary on the incline would be exorbitant, and that they would be less secure than steel. Accordingly, the substructure was built on "skyscraper lines" of stout girders and cross-beams riveted together. Accustomed to seeing a tile or brick dressing over the steel skeletons that support many modern buildings, an observer gains the first impression that the apartment building's base is fragile, but it is capable of far greater strain than brick walls, engineers assert. Because of the airy space left under the lower floors, they are practically free from dampness.



Apartment Building on Its Foundation of Braced and Riveted Strong Steel "Stilts"

SHADE HOLDER SOUNDS ALARM IF CURTAIN IS TOUCHED

To keep intruders from entering windows, a bracket for shade rollers has been invented that sounds an alarm when the curtain is moved. Any disturbance causes an electric contact to be made in the mechanism of the holder which is wired to a bell. The device is said to defy efforts to prevent its action, as the slightest tampering will set it in operation. When desired, the apparatus can be put out of commission by throwing a switch.



¶One engine per hour for thirty-one hours was the production record recently set by the Baldwin Locomotive Works.

"Slicing" Off a Dangerous Point in Panama Canal with Dynamite: Right, Dredge Going into Action on Slide Rock

Rock Drills and Other Equipment Used in "Trimming" the Canal Removed while Dynamite Does Its Work

FLORAL CARPET RIVALS BEAUTY OF TAPESTRY

"Woven" from the fragrant petals of more than a million flowers, a floral carpet formed one of the principal exhibits at the inauguration ceremonies of an Italian school in New York. Within a gorgeous border of intricate design, was a representation of "The Nativity" entirely portrayed in the leaves of roses, asters and other blossoms so skillfully blended and arranged that the figures had the appearance of those on tapestries. Shading and high lights were accomplished with different colored flowers, the fragments being so deftly handled that facial expressions were as vivid as in an oil painting. As the "threads" faded, mellow tones and soft shades lent the carpet added beauty. More than three months' preparation and ten days' work were required to complete the pattern which was designed and executed by Michaele Falanga, known as the "Flower Wizard" for his artistic creations.

Michaele Falanga Putting Finishing Touches on Floral Carpet: At His Right Are Some of the Blossoms from Which Petals Were Picked to "Weave" the Design

TRUCK BODY RISES AND TILTS TO EMPTY LOADS EASILY

For depositing loads at levels higher than the truck bed, an automobile dump body, recently invented, can be elevated by hand-operated gears. The arrangement requires but little power and, it is said, can be fitted to almost any type of frame. The hopper may be made to extend beyond the rear of the car so that its contents will drop within a limited space. It is claimed to be of advantage where granular matter is to be unloaded behind street curbing, since the pile will form without resting against the body, to fall into the roadway when the truck is withdrawn. A release mechanism causes the apparatus to return to the normal position automatically. Sand, gravel, and similar substances can be poured directly from the elevated body into reservoirs of concrete mixers, eliminating the necessity of storing the materials in bins or heaps.

Hand-Elevated Dump Hopper for Automobile Trucks that Deposits Loads on Raised Platforms

RADIO BATTLE AGAINST FRAUDS TO END STOCK SWINDLES

Radio has been used effectively by a Cleveland, Ohio, bank to warn its clients against investments in schemes of doubtful value and to broadcast descriptions of securities known to be worthless and make known the methods of "fly-by-night" salesmen who fleece unsuspecting investors. Word of the plans of the men believed to be swindlers is conveyed to the company by advisors. A "talk" is prepared explaining the fraud and is concluded with the words, "Before you invest, investigate."

COMMENT AND REVIEW

WHEN the automobile was passing the point where its possibilities for practical use first became apparent, the saturation point, beyond which few cars would be sold, was set very low. Each succeeding year the final limit of sales has been advanced until now the total number of registrations is in excess of 12,000,000 cars, which alone furnishes a permanent annual replacement market for 2,500,000 cars. These figures will, however, expand with the building of more permanent good roads, which are constantly enlarging the number who can use a car profitably. Then the natural increase in population year by year gives additional source of increased sales.

Increase in Automobiles

In another 20 years the population of the United States will probably be not far from 150,000,000, which at the present ratio would see nearly 30,000,000 cars in use, with a replacement of worn-out cars of about 6,000,000 per year. This figure will be not far from correct unless the entire country is covered with good roads by that time, or builders find a way to produce cars with a longer life than at present. When one recalls how many years elapsed before the umbrella, telegraph and telephone were adopted for general use it seems hardly possible that in only 20 years the yearly output should have grown from 21,000 to over 3,000,000 cars.

THE large harbors and navigable river mouths of this country are dotted with great ships lashed to docks or anchored singly or in groups.

The vessels which cost several billion dollars to construct are for the moment worthless for want of cargoes. No artificial means exists to restore value to these ships. They must wait the reviving influence of demand. This will be some years, during which, depreciation and improvements in construction and operation will cause irretrievable loss.

World's Merchant Marine

It is interesting to note the opinion of one of the world's greatest authorities on merchant marine, Sir Wescott Abell, who says: "In all probability about 3,000,000 tons of war-built vessels, a million or more tons of normally obsolete ships, and a million tons which have become obsolete owing to recent developments, will have to be disposed of before the world's fleet is restored to efficiency."

Our own shipping board is offering steamships at ten cents on the dollar of cost. Occasionally they do manage to sell one.

ONCE again film producers are considering the question of an automatic machine which will phonographically announce the words which are now flashed on the screen in printed letters. The idea is by no means new, but here and in Europe, several times during the past few years, announcement has been made of a "successful machine."

The Speaking Screen

That such a device can be worked out scientific inventors admit, even though a perfect synchronism of picture and spoken text involves exact construction and operation. The effort would, naturally, increase cost of production considerably, though producers seem willing to assume this expense if it will improve their show or please their patrons.

But will it? All these years patrons have from the first been accustomed to have the necessary explanation presented in the form of printed words thrown on the screen. At present the entire action on the part of patrons is

confined to a single sense—that of sight. To introduce spoken words means both eye and ear must be alert all the time. As the listener cannot know when the announcements are coming, he is under constant ear strain not to lose any essential explanation, lest the ear lose more or less of what is said. The printed text comes on the screen alone, the eye changing merely from picture to text. Moreover, if the reader misses part of the lines on first glance, he usually has time to reread before the message fades. Unless the spoken lines were repeated every time, and that is undesirable, he must catch all the words the first time or lose them. This constant watchfulness not to miss a word would produce a mental strain which would be fatiguing. Under these circumstances does there seem to be any real advantage in the spoken word?

Campaigning by Radio

DURING the previous presidential campaign, the insistence of party managers, and the natural desire of the people to look into the face and hear the voice of the two candidates, have almost compelled a candidate to tour the land from ocean to ocean on a speaking trip, even when he was our President in office at the time. However satisfactory this has been to the voters, such an effort must be at great cost in health and vitality to the candidate, and in the case of one at the time occupying the highest office in our land, with a certain loss in dignity, coming down, as it were, to the level of stump orators and candidates for ordinary town and county offices.

The radio, however, avoids this condition, and the utterance of a President from the White House carries dignity and weight, even though his utterance is really in furtherance of his own re-election. We predict that in years to come this method of appeal will be found acceptable to voters, campaign managers, and especially to the candidate himself. Besides, there is a strange, very forceful psychology, when a listener in a small remote hamlet realizes the words he hears are at the same instant being received at every other hamlet and city from the Atlantic to the Pacific, and from the Great Lakes to the Gulf, and even our possessions beyond the seas. It is a joy to be privileged to live in an age when mind and word are becoming so far reaching and universal, and which will very soon extend their utterances to the farthermost point on our Earth.

"Dixmude," the Deadly Dirigible

LIKE dream fiction in a Jules Verne tale of a generation ago, the great dirigible "Dixmude" sailed away into the vast ocean of air, and, like so many mystery ships of the sea, disappeared and left little clue to the cause of its wreck. Built in greatest haste during the war by the Germans to bomb London, the craft had been pronounced by many engineers as unsafe in a gale. Investigation shows the ship went up for a short trial cruise with a small supply of gasoline aboard. Caught in a storm, which also wrecked ships at sea, it was driven this way and that, the toy of the winds.

During the search, the fastest craft of several navies scoured the seas; while on land, airplanes, automobiles, and even camels were used in the hope of rescue. Shifting like a mirage, the airship was reported one day over the Mediterranean Sea, and the next high above the deserts of Northern Africa. But always elusive, and no message dropped to tell the weird tale of the prisoners wandering in the wilderness of space. It could neither be steered nor propelled. Even had the crew been able to descend on land the ship would have been totally wrecked, as not less than 200 experienced landing men were required to bring it safely to anchorage.

The few bodies recovered from the Mediterranean confirm the belief that it went down at sea, and some charred fragments indicate the immediate cause was due to explosion. An explosive gas was employed, but as the engines had

been idle probably for several days, the explosion might have been from a stroke of lightning. The fall was evidently from a great height, as all the limbs of the commander were broken when his body was found in the ocean. The officers and crew numbered some fifty men.

This magazine in the past has expressed its conviction that the dirigible is very limited in its uses; that by reason of its size it must always be uncontrollable in a high wind; it is costly and frail; as a vehicle of commerce it offers no promise of ever becoming a reliable, dependable medium of transportation. Nor can it ever be compared to a large ship at sea, one third of which is below the water line where a keel affords some hold. There is a dispute among sea captains as to whether the monster ocean ships are as safe in a storm as smaller vessels.

The "Dixmude" is the third dirigible accident within a short time in which great loss of life occurred.

The recent performance of the U. S. "Shenandoah," which fought a 60-mile-an-hour gale for nine hours, indicates a better performance due to better construction, partly, and probably, to a large degree, the splendid work of her officers and crew. We all, naturally, have reason to be very proud of our ship and men. The fact remains, however, that had the "Shenandoah" been sent on a highly important mission to a definite destination, which made it necessary to arrive there at a predetermined hour, she would have failed, had the destination been other than where the gale carried her. As it is, we are thankful and lucky to get the ship and her crew safely home to her hangar. The flight was an involuntary one, as the ship broke loose from her moorings at the top of a 167-foot mast. After the storm broke it was impossible to get her into the hangar.

Talking to a Nation

WHEN President Coolidge recently broadcast his address on the proposed Harding Memorial, it was the first time in the world's history that the actual voice of the ruler of a vast nation was heard at the same instant by millions of his people in practically every part of its domain. The possibilities demonstrated and suggested on this occasion are almost limitless. Communities live in peace because they know each other. Our States continue in peaceful relationship for the same reason. Canada and the United States have lived side by side in perfect amity because we know each other; and, knowing, make understanding allowances.

There are nations in Europe much smaller than many of our counties, where the people of one town cannot talk with those of another town only ten miles away. Their language is entirely different. Hence race hatreds, hundreds of years old, continue, and wars persist, chiefly for want of ability to speak with each other.

In proportion as these people become able to understand the speech of the others, they will grow to think in the same terms.

What a tremendous aid to mutual understanding, therefore, and in consequence, a mighty increase in confidence, when the President of the United States, in his office at the White House, can personally present his views on subjects of vital importance direct to millions of his own people. He has done so in the past, of course, through the daily papers, but the telephone has taught us how much more personal is the actual voice of one dear to us than a letter from the same person.

The possibilities, therefore, as the radio is improved and increased in numbers, are almost beyond comprehension at the present time.

H. H. WINDSOR

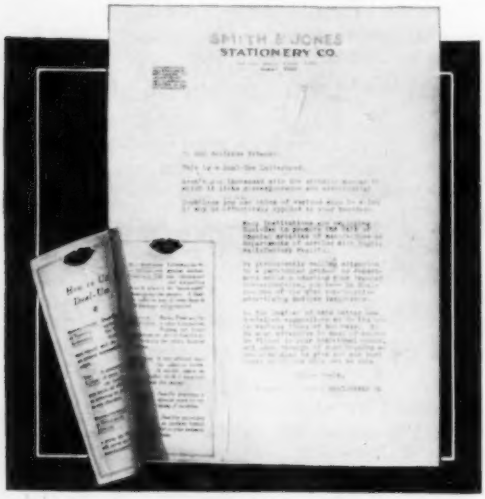
WHALE IS KILLED AFTER SEVEN-HOUR BATTLE

Surrounded by fishermen in a narrow inlet four miles from a large town in Denmark, a monster Greenland whale, which had invaded the shallow waters, fought its captors for seven hours before they finally killed it with rifle shots. Measuring fifty-five feet in length, the huge animal was towed to shore and lifted with a powerful block and tackle. The presence of the creature was discovered when a fishing boat collided with it while putting to sea. Although pierced by many bullets, the whale put up a terrific battle, until weakened by exhaustion it died of the wounds.

Monster Whale Killed by Fishermen after It Invaded a Narrow Inlet in Denmark

BOOKLET ATTACHED TO LETTER IS AID TO ADVERTISERS

To save postage and wrapping material and to insure attention from the person receiving it, a small three-page booklet has been designed at the lower corner of a letterhead. Space is provided for a cover and two inside pages and, in case a larger volume is desired, more leaves can be inserted. The addition is placed so that it does not interfere with the body of a letter that can be written on the sheet. It is claimed that by its use costs are lowered, since little more labor is required to print both the top and bottom of the page.



Printed Booklet Made Part of Letter to Save Postage and Insure the Attention of the Reader

SPARROWS DEFY GAS "ATTACK" IN WAR ON BIRD PESTS

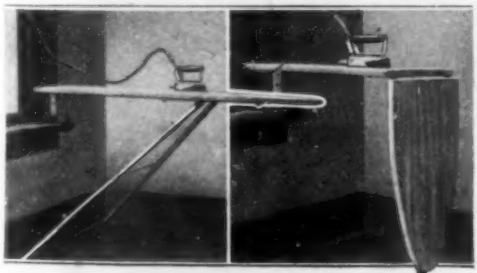
Resisting the fumes of mustard gas, and other deadly chemicals in quantities that would have proved fatal to a human being, English sparrows and domestic pigeons survived gas "attacks" in recent tests conducted by the government to find a way to rid the country of various bird pests. The subjects were placed in tight compartments, so arranged that the observers could watch their actions. The gas was administered in varying quantities. Amounts that would have killed a soldier caused the specimens to evince little agitation, and they recovered when taken into fresh air. In all, six varieties of gas were tried but without the desired effect. The experiments emphasized the difficulties encountered in ridding the country of the English sparrow in particular.

MOTOR SHIPS OUST STEAMERS BECAUSE OF LOWER COST

Savings in running costs, due to decreased fuel consumption, especially on long voyages, and larger carrying capacity, because less space is required for storing oil, have caused wide adoption of motor ships in preference to steamers in new tonnage for British lines, according to an English journal. Engineers have figured that a motor ship of 9,000 tons dead weight, burns approximately twenty tons less oil per day than a steamer of the same size, thus enabling it to carry more cargo and allowing it a wider radius. The steamer's relative cargo-carrying capacity falls off rapidly on long voyages of 6,000 miles, or more, decreasing from sixteen to twenty per cent for that distance as compared to one of 1,000 miles, owing to the large storage space required for fuel. One English company sold its steamers not long ago and now owns twenty motor ships.

IRONING BOARD FOLDS ON WALL OR BECOMES SMALL TABLE

For use in households where space is an important consideration, and to save time, a folding ironing board that can be attached to a wall by a hinge has been patented. If its full length is needed, a pair of light wooden legs, furnished with the device, rest at an angle against the floor



Wall Ironing Board with Folding Extension that May Be Easily Converted into a Table

at the bottom of the wall to support it. When only a small part of the board is necessary, half of its length can be dropped down, forming a table. It may be quickly detached from the hinge and placed out of the way when not in use, or it can be left to hang flat from the fastener and can be easily handled.

¶Approximately two-thirds of the world's inhabitants belong to the yellow, black, or brown races

PORTABLE BARREL LOADER AIDS IN FILLING FREIGHT CARS

Saving both time and labor, a portable barrel loader has been built for filling the upper tiers of a freight car. Easily moved

Electrically Operated Barrel Loader for More Easily Filling Upper Tiers of Freight Cars

along a warehouse platform, it is operated by electricity, eliminating much of the heavy lifting usually required. Also, it is said to lessen the possibility of accidents due to the slipping of the heavy containers.

SPRING IN AUTO TOW LINE EASES STRAIN ON CARS

Jerking and sudden strain are avoided in pulling automobiles by a patented tow line with a strong spring section which takes up the starting shock so that the force is applied to the car gradually. Danger of snapping the line is lowered, there is less wear on the cars and little likelihood of "killing" the engine in the for-

Tow Line with Spring Section that Acts as Shock Absorber When Attached to Cars

ward car. The line is easily attached by hooks on both ends to loop over the axles and it cannot slip off.

Railway Tunnel, High in the Andes, Where the Winds Are So Strong that Huge Wooden Doors Have Been Placed at the Entrance to Permit Ascending Trains to Make Headway

In Mountains of South America Where Man's Engineering Feats Have Conquered Nature's Perils

Feats of Railroading in the Andes

Marvels of Engineering Required to Span Mountains, Conquer Wilds at a Cost of $100,000 a Mile

By PRESTON E. JAMES
University of Michigan

SOME one very aptly called the Andes a geographical tragedy. Rising to great elevations, they stretch in an unbroken barrier from the Caribbean to Cape Horn. In places their sides are drenched with tropical rains and dense vegetation clings to the precipitous slopes and clogs the narrow valleys. In places it is so dry that rain has never been known to fall and here there is no vegetation at all, only barren, wind-swept plateaus and slopes which do not support even a blade of grass or a speck of moss—such landscapes as the astronomers tell us exist in the mountains of the moon. Amid such surroundings man is crushed by overpowering nature. His greatest feats of engineering crumble before the strength of the forces which oppose them. Against such odds it is no wonder that many of the countries in western South America have made slow progress, as their biggest problem is that of transportation. Before railroads were invented, three forms of transportation were in use. One was, and still is, the patient mule, carrying loads of from 200 to 300 pounds, and covering thirty to forty miles a day. Another is the native

Zigzagging between Towering Mountain Peaks

beast of burden, the llama, which carries only 100 pounds, and travels seldom more than ten miles a day. The third method is by Indian carriers, who can pack a load of fifty to one hundred pounds with ease and travel as much as twenty-five miles a day. But real development did not begin until the railroad made its appearance and today only those portions which are reached by steel highways show much prosperity.

The obstacles encountered by the engineers were discouraging to all but the most persevering. Many ambitious projects were begun, but only a few have been completed. At present only a single railroad actually crosses the Andes from one side to the other, and that one connects the big cities of middle Chile with the fertile pampa of Argentina. Here the mountains are not so broad as farther north, although the pass is at an elevation of 12,602 feet above sea level. Furthermore, in the south the Andes separate two prosperous nations, Argentina and Chile.

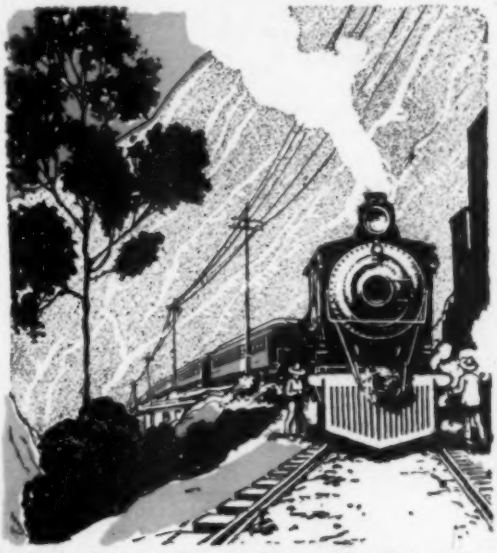
The trans-Andean railroad runs from Valparaiso, the chief seaport of Chile, to the beginning of the steeper part of the climb at Los Andes, on broad-gauge track. There the narrow-gauge begins. In the ascent several sections of rack and cog are used, and the grade at places reaches eight per cent. On the Chilean side the snow is heavy in winter, and landslides very often block the track for months at a time. The highest point is reached at an elevation of 10,463 feet, where the train enters a tunnel and descends toward Argentina.

So strong are the winds on the western side, that large wooden doors are placed at the upper end of the tunnel, for otherwise the trains ascending from the east could scarcely make headway. Although this road still enjoys the distinction of being the only line to cross the mountains, it will not be long before several other trans-Andean railroads will be added to the list. One of these new lines will connect northern Argentina with Bolivia. A gap of 150 miles separates the two ends of the line, and construction is being actively carried on by an American company. This line will reach the highland cities of Bolivia, which are already connected by rail with ports on the Pacific coast. In addition, two other trans-Andean lines between Chile and Argentina are projected and construction on them has been started. One is in the north between the towns of Salta and Antofagasta on the Pacific; the other in the south where the mountain passes are much lower and construction much simpler.

Bolivia also is making great efforts to finance a line from Cochabamba in the

Where Only Poison Sprays Will Check Tropical Growths

mountains (already connected by rail to the Pacific) to Santa Cruz in the plains east of the mountains. A large part of the territory of Bolivia lies east of the Andes, but this section has never been settled, in spite of the fact that it is potentially very rich. The railroad will pass through a region where the rainfall is heavy. The valleys are narrow, V-shaped gorges with steep sides, and they wind about so much that to follow them would add many miles to the line. Moreover, there is always the danger of floods close to the rivers during the rainy, or to be more exact, the rainier season. There is no level ground between the streams, and therefore the tracks must be laid on the valley slopes where they are constantly exposed to avalanches.



Tracks Laid on Mountainside at a Cost Estimated at Approximately $100,000 a Mile

To these difficulties must be added that of luxurious vegetation. Grasses and coarse weeds grow very rapidly and a roadway cleared of vegetation will be covered and completely blocked again within a few months. Poison sprays must be used constantly in order to keep back the rank growth. Ants and insects eat the ties, so that they must be replaced much more often than ties in this country. Metal parts rust very rapidly unless they are coated with paint

Then, too, human beings suffer in such a climate, many diseases and fevers claiming the out-of-door workers in particular. On one such railroad it was necessary to recruit 3,000 laborers in order that 300 might be kept constantly on the job. It is small wonder that the line from Cochabamba to Santa Cruz is estimated to cost $100,000 per mile.

Unquestionably the most remarkable engineering feat in mountain railroading is the famous Oroya railroad in Peru. This line has the distinction of reaching the greatest elevation of any standard-gauge road in the world, and that without use of rack or cable. The line climbs to a height of 15,665 feet in 106 miles. It takes about nine hours and thirty-eight minutes to mount to the summit, an average rise of twenty-seven feet per minute. To make the grades possible, Henry Meiggs, who built the line, resorted to switch-backs. Just before entering, and just after leaving San Bartolome, the line passes through two short tunnels under the river, thus avoiding the danger of washouts. After sufficient elevation has been gained by backing, the train runs onto a level place, a switch is changed, and the train continues its climb, now running forward up the valley. In this manner, swinging first back and then forward, the necessary elevation is gained, but at no place with a grade exceeding 4.08 per cent.

Not far above San Bartolome, the Rimac valley narrows to a gorge with almost perpendicular sides, and with towering mountain peaks rising to stupendous heights above it. The engineer who could have imagined a railroad through such a valley must have been touched by that form of insanity which is called genius. The single track clings to the steep slopes on a bench cut from the solid rock walls, until a projecting spur requires a tunnel. Then the line dives into the mountainside and emerges beyond the spur where a new vista of unimagined heights is revealed.

Then there are side canyons which must be crossed. The train crawls out from a tunnel onto a bridge many feet above the valley floor, only to dive back into a tunnel beyond. The longest of these bridges is called the Verrugas. It is 575 feet in length and 252 feet above the valley. In climbing to the summit the train passes through sixty tunnels, over forty-one bridges, and thirteen zigzags.

At one point, near the station of Chicla, five lines of track are visible on the mountainside, one above the other, and the station, located in the valley, remains visible from the train for nearly an hour while the zigzags are being covered. During the climb the passenger passes successively through a number of different climates. The coast is tropical and its products are

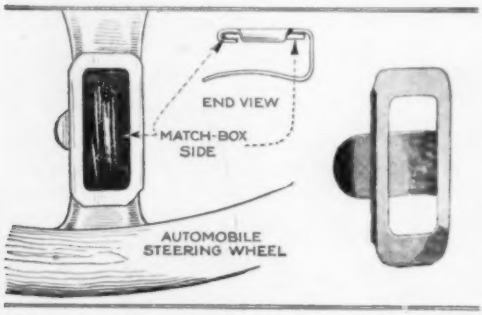
characteristic of warm countries. As one continues to rise, however, products of cooler climates are seen, first corn, then wheat and then barley. Finally the point is reached where nothing will grow but the small, bitter, Peruvian potato. Nowhere are there any trees, except those planted around the stations. The tall, graceful pine trees of the Rockies are entirely wanting, with the result that while the scenery is grander and more awe-inspiring, it is never as beautiful.

Another noteworthy thing in this rapid climb from sea level to over 15,000 feet, is the rare atmosphere. Because of the smaller amount of oxygen at the higher elevations, one must breathe in larger amounts of air to achieve the same results as at sea level. The slightest exertion leaves the passenger panting for breath. Persons with weak hearts often suffer from mountain sickness. Instead of feeling exhilarated, they are nauseated.

At one time an overzealous inventor constructed an airtight car for this line. The car was filled with air at the sea level pressure, and the passengers were shut up in it. Of course, the trip was made in perfect comfort, the scenery being enjoyed through the large glass windows. But the inventor might have foreseen the result of leaving the car at Oroya. Instead of making the change of air pressure in the space of nine hours required for the trip, the change was made in a fraction of a second, when the doors were unsealed, and the passengers stepped out. The strain was too great, they all became unconscious and were not revived until they were brought back to sea level and normal conditions.

MATCH SCRATCHER FOR AUTO CLAMPS ON WHEEL ARM

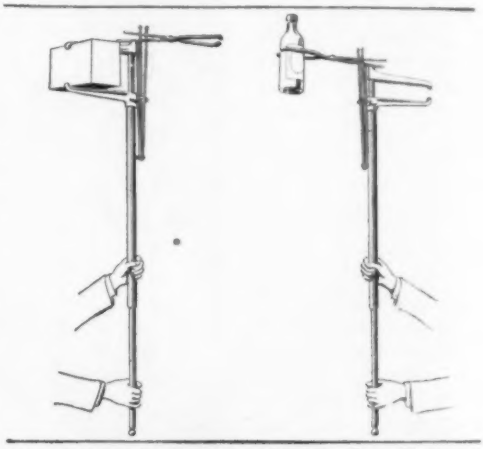
For the convenience of motorists, an inexpensive match scratcher has been patented which clamps about one of the arms on the steering wheel. It is an aluminum shield under which a piece of emery board is slipped to provide a striking surface. It is within easy reach while offering no obstruction to the driver's hands in steering.



Match Scratcher that Fits on Arm of Automobile Steering Wheel without Obstructing the Hands

LIFTER REACHES HIGH SHELVES WITHOUT A STEPLADDER

With an extension holder that has strong clasps or pincers at one end, boxes, bottles and other things can be picked up and placed on shelves without the aid of a stepladder. The invention, designed by a Frenchman, has two sections, one fitting into the other so that it can be adjusted to various lengths. When the upper part is pulled downward, the clasp is opened to take hold of the object. A reverse movement closes the jaws and holds the article while it is being lifted into place. A slight downward pull on the rod releases it. Two styles of clasps are made, one for round objects and the other for boxes or packages. The "gripper" weighs but little, and is simple to operate.



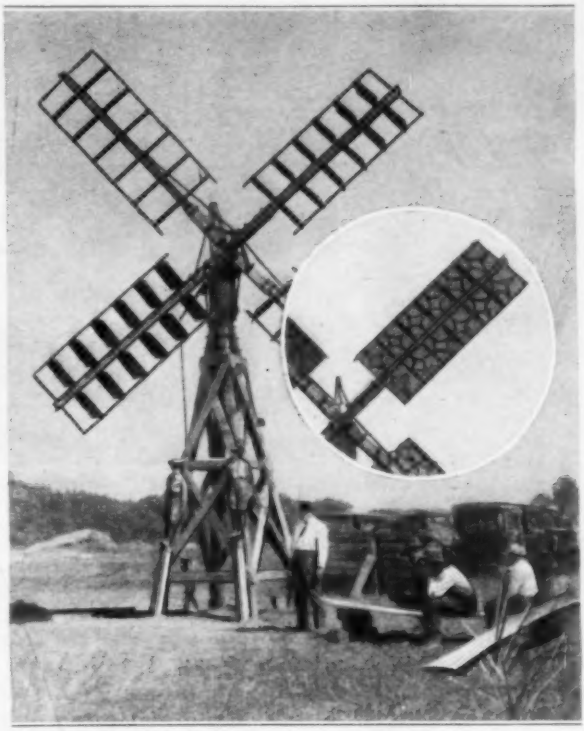
Lifter Adjusted for Package and Bottle; Jaws Tightened by Grip on Extension Handle

GASOLINE SAVED THROUGH TEST OF AUTO EXHAUST GAS

By proper adjustment of the carburetors on a fleet of government motor trucks, after analysis of the exhaust gases had been made, a saving of twenty-two per cent in gasoline was effected. Experiments by the bureau of mines also are said to have proved the feasibility of a portable indicator to show the kind of gases given off and to remove all guesswork in making proper adjustments of the carburetor.

FARMS ARE WATERED BY WIND HARNESSED TO PUMPS

Windmills, resembling those common to Holland, have been found practical for irrigation and power purposes in Kansas. Sufficient water may be pumped from a depth of 75 feet to irrigate a farm of 80 acres with one of the mills which operate two pumps simultaneously. The wing blades have an exposed surface of 144 square feet and are so arranged that in severe winds the sails open edgewise, allowing the blast to sweep through without damage. The wheel and scaffold are of simple construction and require little repairing.



Handmade Kansas Windmill for Power and Irrigating with Swinging Wing Blades. Inset Shows Them Folded Flat

Because of the extent of the wing surface, the mill is set in motion by only slight winds and a high tower is not necessary as with smaller wheels. With the exception of the gears, practically all parts of the outfit can be made by hand with only a few tools. Thin strips of sheet iron have been found suitable for the blades. They are easily adjusted into the frames fashioned from light iron or steel rods. Cross-arms are cut from strong wood and are braced with iron straps. This style of mill has proved so successful in the locality where it has been tried, that several others like it are being constructed. By setting the blades edgewise, the wheel can be thrown "out of gear" as it will not catch the wind. The short tower requires less wood than a high structure and is considerably cheaper than one of steel.

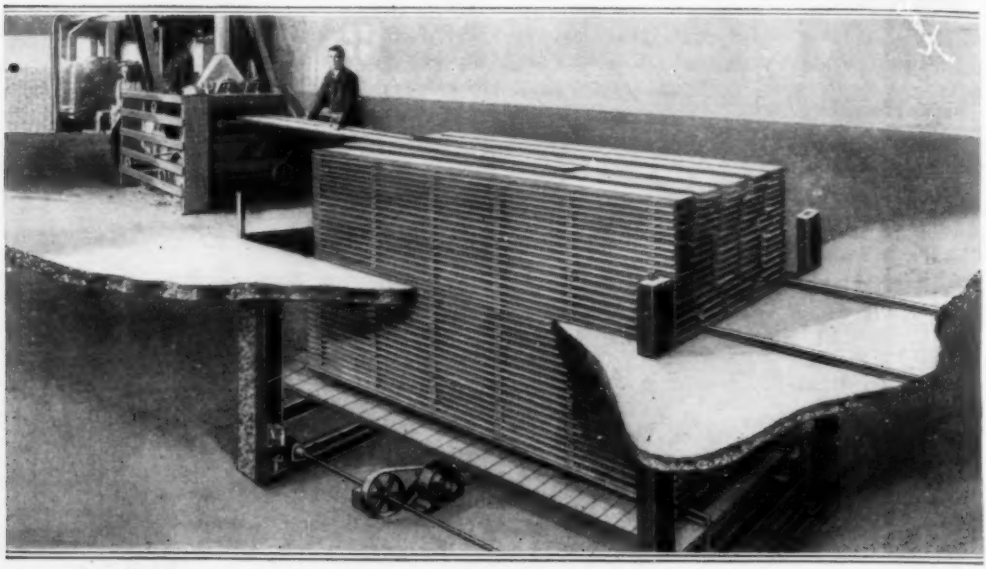
FIREPROOF BRICK OF SAWDUST TREATED WITH CHEMICALS

Sawdust treated with chemicals, under a secret process discovered by a southern manufacturer, and subjected to heavy pressure, is said to have been used successfully in molding fireproof bricks for building purposes. They are said to be durable and easily handled, and have heat-resisting qualities superior to many other kinds. The dust is soaked in certain solutions and pressed in special molds. Tile is also manufactured from the material.

Molding Fireproof Brick and Tile from Sawdust that Has Been Soaked in Chemical Solutions

¶Barely visible to the naked eye, threads from melted quartz can be made so small that a bundle of a thousand of them is as small in diameter as a human hair.

LUMBER LIFT FOR SAW SAVES TIME AND LABOR



Elevator for Raising Lengths of Lumber to Saws, Making the Handling Easier and Resulting in Speeding Up Production, Increased Efficiency and a Saving in Material

To make lumber handling easier, increase efficiency and speed up production, a lift is being made that delivers the wood directly to the saws. The old method was to bring the lengths as close to the machine as possible and throw them on the floor, from which they would be picked up and loaded on a truck for the worker. This is said to have resulted in splintered lumber and required more men for the handling. The elevator can be built entirely above ground.

HAIR WAVER FOR USE IN HOME SAVES TIME AND EXPENSE

To save time and expense for the woman who wears her hair waved, an electric marcelling iron for use in the home is being made by a New York concern. Easily operated, the device can be used by the owner to dress her hair without other aid. Wound in the form of a figure "8," around two tubes, the strands quickly take on a wave with but a slight application of heat. It is claimed that the crimp will last for from three to ten days. The appliance is attractively designed, and has no moving parts to get out of order. It can be connected to an ordinary light socket.

Electric Hair Waver without Moving Parts that May Be Safely Used in the Home

DIMPLED TUBE FOR TIRE STOPS FRICTION AND PUNCTURES

To prevent creeping inside the casing, the surface of an inner tube for automobile tires is being covered with dimples which cause it to cling to the outer section. Thus friction, which creates internal heat, is believed to be reduced by the many vacuums formed by the depressions. The rubber is also leakproof, it is said, because the inside is covered with a soft compound which is quickly forced by the air pressure into openings left by punctures. By hardening and curing under the compression, the material is said to make a permanent repair in the damaged tube.

RETORT FOR EXTRACTING OILS CONTROLS OWN HEAT

Built in sections, each with its own furnace, a retort designed for extracting oils from wood, coal, tar, sands and similar substances has a control for automatically regulating the heat of the ovens. Any temperature desired can be maintained in the individual furnaces and, it is said, the arrangement prevents overheating or "cracking" of the products. The gases are drawn off in regular order, so that the most economical results may be obtained. The appliance may be run at almost any desired speed and is mechanically supplied with raw matter. If necessary, the machine can be made portable. The power required to operate it, it is claimed, is less than is ordinarily needed.

ELECTRIC SEALER HAS STAMP AND HEATER FOR WAX

To save time and prevent injuries to fingers while holding sealing wax over bare flames, an electric iron is being made that has a heater for melting the compositions and a stamp for impressions. It is claimed that the device quickly softens the wax without burning, thus causing it to form closer and more durable contact with the surfaces than is possible with the old method. Small round wafers of sealing material can be supplied for the machine and aid in making a neat and clearly defined disk. The apparatus is of sound construction, is light in weight and has no delicate parts that might become damaged.

ELECTRICAL IMMUNITY IS DUE TO DRYNESS OF SKIN

Electricity will not pass through the bodies of all persons with equal ease, according to the assertions of experts. One prominent scientist has been known to resist a voltage that often has proved fatal, due, it is said, to the dryness of his skin.

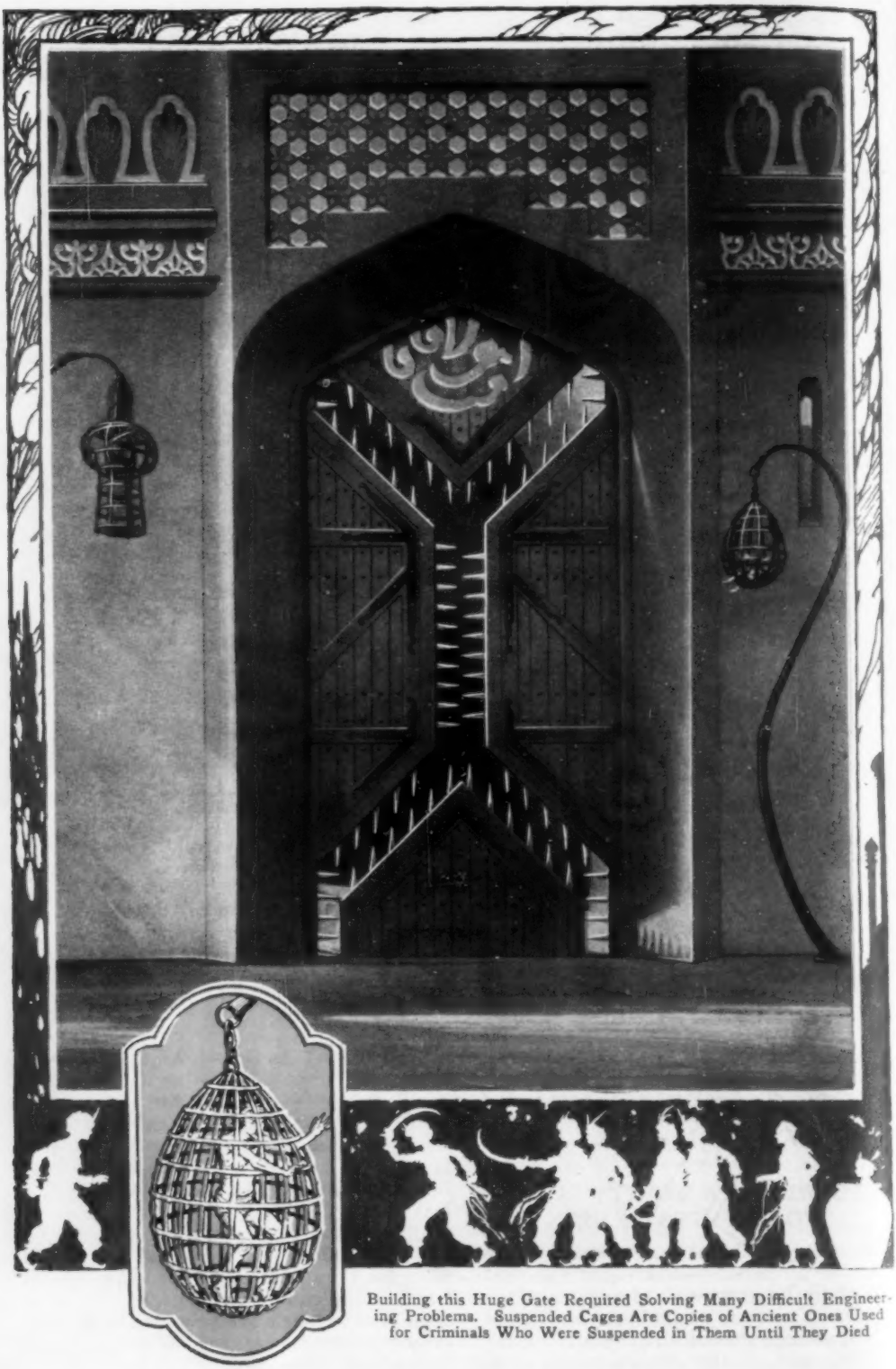
ENGINE FRONT PAINTED WHITE TO AVOID ACCIDENTS

So that switchmen can readily see the locomotive fender in the darkness and so avoid accidents, a steel company in Middleton, Ohio, has painted the step white. In this way, considerable of the risk of missing the running board has been eliminated, and the number of deaths and injuries from this cause decreased.

Running Board of Switch Engine Painted White So that It Can Be Seen Plainly in the Dark

INSECT WAR PLANNED TO END THE HESSIAN FLY PERIL

To exterminate the Hessian fly, one of wheat's greatest enemies, science is preparing to call to its aid a parasite, known as the platygaster himealis. A mere speck, when not viewed through the microscope, this foe of the fly is no match for it in open combat. Instead it stings the eggs, leaving behind infant parasites that eventually kill their host. When the last fly has been slain, the tiny insects will perish also, for they will have killed the species which alone can give them life. Preparations for the battle are being made by government experts at the Wichita, Kan., agricultural laboratory.



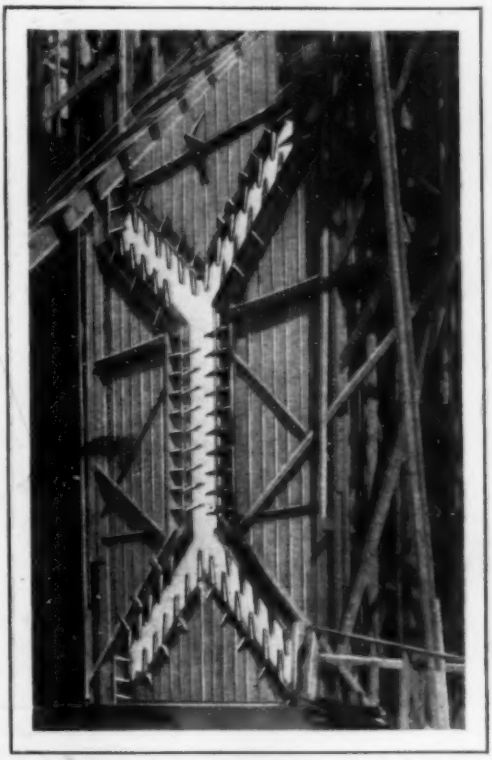
Building this Huge Gate Required Solving Many Difficult Engineering Problems. Suspended Cages Are Copies of Ancient Ones Used for Criminals Who Were Suspended in Them Until They Died

Engineering the Magic Carpet's Flight

Problems in Mechanics that Make the "Movie" Engineer's Profession Recall the Magician's Miracles

"BUILD me a magic carpet on which I can ride; a flying horse like Pegasus and arrange a set so that I can disappear in a whirlwind."

The "boss" of the moving-picture lot, without more ado, walked out of his chief engineer's office, leaving that hard-working individual the three problems which he mentally added to the score or more of similar commands he had executed since the actual "shooting" of the scenes in the huge spectacle had begun months ago. For the engineering staff of the larger moving-picture producers is used to facing and conquering problems that for sheer unusualness are perhaps unrivaled.



Back of Gate Weighing Seven Tons Yet Operated by One Man, So Accurately Was It Poised

As the theater patron watches the unfolding of the silent drama and sees huge buildings flashed on the screen, great idols being worshiped or destroyed, hordes of actors engaged in furious warfare, castles being besieged, glimpses of seemingly ancient wagons hauling victims of the French revolutionaries' rage to the gaunt, terrifying gibbet—as he follows the thread of the story—but a passing thought is given to the astonishing accomplishments of the engineer.

A visit to the plants of the moving-picture industry leaves the spectator with at least one assurance—that few scenes in any of the so-called "super-spectacles" would be possible at all were it not for the services and skill of the engineer and other highly trained technical men. Every branch of mechanical knowledge is put into action when the "boss" gets an idea. Walls must be made solidly of concrete, but constructed so that they can be removed with ease when they have served their purpose. To be sure, a great many of these seemingly huge buildings are but shells—perhaps just "fronts"—but even these must be made in such a way that hundreds of persons may "act" upon them without fear of a fall or of the collapse of the structure. To create a whirlwind to accommodate an actor who wishes to disappear is not simple, yet the engineer who says, "I can't," quickly gets another position.

In the designing of a huge gateway to represent the childish whim of an ancient ruler of the Far East, one of the most perplexing problems of the engineering department of one big producer was solved. The gate had to part into four sections, one sinking into the ground, another being drawn upward and the two sides being pulled away from each other and into the castle wall. Since the gate could not be square, the two sides traveled a shorter distance in being withdrawn than did the top and bottom pieces. A nice problem in mechanics was thus involved. Again, the door being of wood, it was difficult to build it sufficiently rigid to insure that the teeth, with which the edges of the four parts were armed, would come together accurately. Yet, although completed the gate weighed seven tons, its mechanism was so skillfully designed that one man could operate it by means of a

series of pulleys and cables. Incidentally, it was conceived by one of the workmen and cost $8,000.

Particularly difficult was the task confronting the engineers in a sensational drama where, because the story concerned a fairy tale, as few straight lines as possible were demanded. Stairways were crooked and in proportions only reasonable in a dream; windows were of odd outline; streets were "crazy" shaped; caverns and strange gods vied with intricately molded metal cages big enough to imprison full-grown men and hovels and palaces of the strangest aspect.

A scene was desired showing a cross-sectional view of a thieves' burrow beneath the surface of the ground, yet with many galleries and peep-holes from which the rascals could note the passing of a caravan of riches. Engineers devised such a structure supplied with a "cover" which, when fitted over the cave, restored the scene to an "above-ground" view. Huge rollers and pulleys were specially made to move this great bulk of material back and forth as the occasion demanded. While a great deal of the responsibility for the making of copies of such "property" as submarines, steamships, airplanes, railroad coaches and so forth, rests on the carpenters and workers in other trades, yet the engineer finds himself called upon frequently to figure out stresses, leverages and other secrets of his profession for the use of the craftsmen. Being unable to secure the loan of real submarines from the government, one producer not long ago set about building one that was 100 feet long, with a beam of fifteen feet and a draft of four feet. The engineer was told that the craft had to be of sufficient strength to withstand submergence to a depth of more than forty feet; would have to be provided with tanks, so that it could take on water to sink it to that depth, while compressed air must be furnished to blow out the water when it was necessary to raise the boat to the surface. The director also wanted torpedo tubes big enough for standard size missiles—and he wanted it all in a hurry. The "sub" was made of sheet iron, but it required six months of constant labor to build it.

Great Idol Built with the Aid of Intricate Scaffolding; a Unique Bit of Engineering in "Movieland"

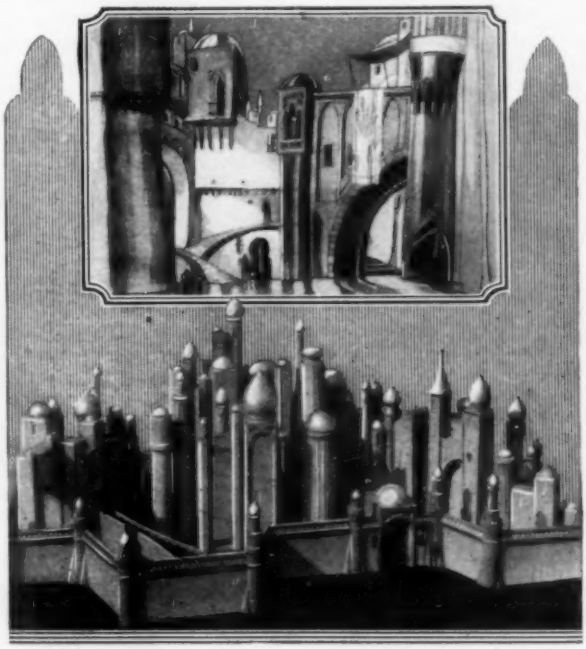
In a recent war play, four giant siege guns were needed. The engineers finally produced wooden weapons which recoiled with full realism when the tiny charge of powder was exploded in their iron-lined barrels. And the variety of the engineer's tasks is limitless. It was desired that an actor in a comedy take hold of a live lion's tail and bite it The engineer was finally called in and asked how mechanics could help save the actor from the lion's displeasure, for even a studio lion has emotions.

"Have both actor and lion perform on a moving platform," the engineer advised. "The lion won't turn around to strike the actor in that case." And so it proved.

For the purpose of another comedy the engineer was told to devise some means whereby a comedian could sail through the air hanging to an ostrich's tail-feathers. The engineer devised overhead strutwork attached to an automobile which followed the running bird and the actor suspended by an invisible wire from the overhead platform.

From the days when Thomas Edison

was experimenting with the "movies" and engineers were called in to build a studio on a turntable so that it would follow the sun during the day and thus permit of taking pictures indoors continuously, to the present when realism must be observed and minute details of mechanical construction followed faithfully, the engineer has been associated with the business. Not only is his science called in for replicas of modern inventions, but he must know how to build vehicles and machines of days long gone. It was he who designed and instructed the carpenters in building medieval wagons for a recent picture. The shafts, wheels and bodies were whittled out by hand to simulate the old-time carts.



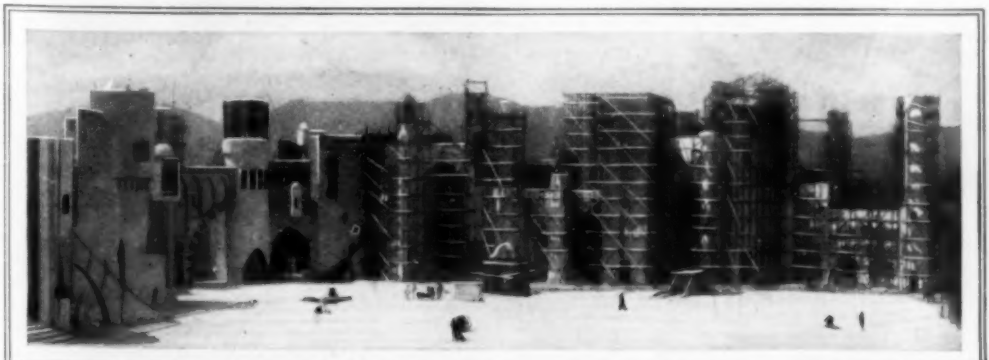
Above: Artist's Conception of Scene; Below, Working Model Constructed from Drawing and Used to Build "Life-Sized" Set

The work of the engineer begins with the acceptance by the directors of the scenario. Following the adoption of an idea, the studio's research men—they may be college professors or other trained scientists—gather all imaginable data on the period and people of the time and countries involved. Artists then make free-hand drawings of how they think the scenes should be made.

Once these are accepted, draftsmen redraw the artists' conceptions to absolute scale. From these blueprints, small models are made. Then comes in the engineer who, from his knowledge of mechanics, weeds out the impossible—if such a thing exists in the mind of a movie engineer—and gives advice on the practicable.

The finished blueprints are then turned over to the carpenter and his crew, the plasterers, the masons, the bricklayers and —the engineer. The latter "bosses the job" until it is done. He is the man who finds a way to make Pegasus fly, to give the star a safe ride on a magic carpet, to waft the villain away in a cyclone and —to make it all seem real to the man or woman who has paid to enjoy a couple of hours of thrills or laughter in the neighborhood movie.

To meet the demand for realism railways have been built on mountainsides on which trains have been wrecked, gaunt skeletons of ocean liners erected on dry land and deserts turned into populous cities.



Set Being Built to Scale from Model of Artist's Drawing: More than Five Hundred Carpenters Worked Weeks to Erect this Eight Hundred Feet of "Background"

LURE OF PEARLS LEADS HUNT IN INLAND WATERS

So valuable has the fresh-water pearl become, that fishermen have taken up the search for them wherever mussels are known to exist, for it is from the shells that the majority of the gems are taken. Rarely is a perfect specimen found, for it must be of a quality having the proper shape, color, and size to meet the requirement of the buyer. Out of about every thousand submitted, the experts find not more than a hundred that are classed as prize articles. The remainder are used in the less expensive mountings. Pearls are picked from the mussel shells in almost every conceivable shape, and in many different colors. Pink, blue, cream-shaded, and even lavender ones are frequently found. The various hues are graded and selected according to size and form. The purest ones, known as special high grade, are sometimes valued at more than $3,000 each, depending on their weights. In dragging for the coveted jewels, the pearl hunter lowers a netlike arrangement of small grappling hooks over the side of his flat-bottomed boat. As it glides slowly over the bed of shells the points of the snares become fast in the opening of the mussels' homes and the valve is pulled closed upon the prong by the wary occupant. Holding tightly to the grapple the mussel is drawn to the surface by the fisherman. The shells are pried open, the interior is cleaned out so the smallest pearl could not be missed, and the empty halves are thrown in a pile to be sold to factories, where they are cut into buttons.

Fresh-Water Pearl Hunter Seeking Jewels among Mussel Shells, and the Type of Boat Used by Fishermen in Their Never-Ending Quest along Inland Streams

GROWTH OF TREES IS FASTER IN CUT-OVER AREAS

Yellow pine trees grown from seeds left in cut-over lands grow much more rapidly and are less liable to die than those in virgin growths, according to experiments made by the Fort Valley Forest Experiment Station in Arizona. Out of thirty-three trees in a virgin forest near the station, eight had died after a period of twelve years, it was discovered, while out of thirty-four on the cut-over tract, only one had died. By boring out a section from the live trees with an instrument that takes a core from the trunk about the size of a lead pencil and measuring the spaces between the rings, it was found that the mean annual growth during the last ten and twenty-five year periods for the trees on the cut-over area was almost twice as great as the growth of those in the virgin stand. Greater space to draw upon for plant food and for moisture caused the faster growth of the trees in the worked-over section, scientists believe.

¶Chestnut trees have been cultivated since early times in the Mediterranean region, where they were first discovered.

CITY OF LUMBERJACKS FLOATS TO TIMBER ON SEACOAST

Lumberjacks living in Simoon City on the British Columbia coast have their houses built to float on the water, so they can be towed along shore to timber tracts where the owners pitch logging camps. Owing to the impossibility of establishing large lumber towns near the woods, big concerns have ignored the heavy "stands" on the mountainous shores. Residents of the floating city took up the task and transport their entire homes to the scenes of action during the working seasons. Rowboats and motor craft are used to tow the "seagoing" dwellings. When the trees are felled and trimmed they are formed into rafts and hauled to near by sawmills. After operations have been completed, it is said, the scattered population cruises back to the permanent town site, where many amusements serve the inhabitants. A floating store is reported to be propelled up and down the coast to supply the needs of the workers and their families, while a postoffice aids in keeping them in touch with the outer world.

BOXING GLOVE ON LEVER SAVES HEADS OF WORKERS

To prevent accidents to workers passing under a moving lever, the end was covered with an ordinary boxing glove by a Detroit

Boxing Glove Attached to Lever on Press So that Accidental Blow from It Would Not Injure Workers

motor-car manufacturer. This tended to deaden the blow and prevent serious injuries from accidental bumps on the head and shoulders of those passing the press.

Believed to be the oldest silver fork in existence, one bearing the date 1632 was discovered recently in England. Its owner is said to have been offered $700 for it.

RESISTANCE OF ROAD AND AIR TO AUTO IS MEASURED

Resistance of the road and air met with by moving automobiles can be measured by a meter invented by a government sci-

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Meter that Accurately Measures the Resistance Air and Road Offer to Passage of Automobile

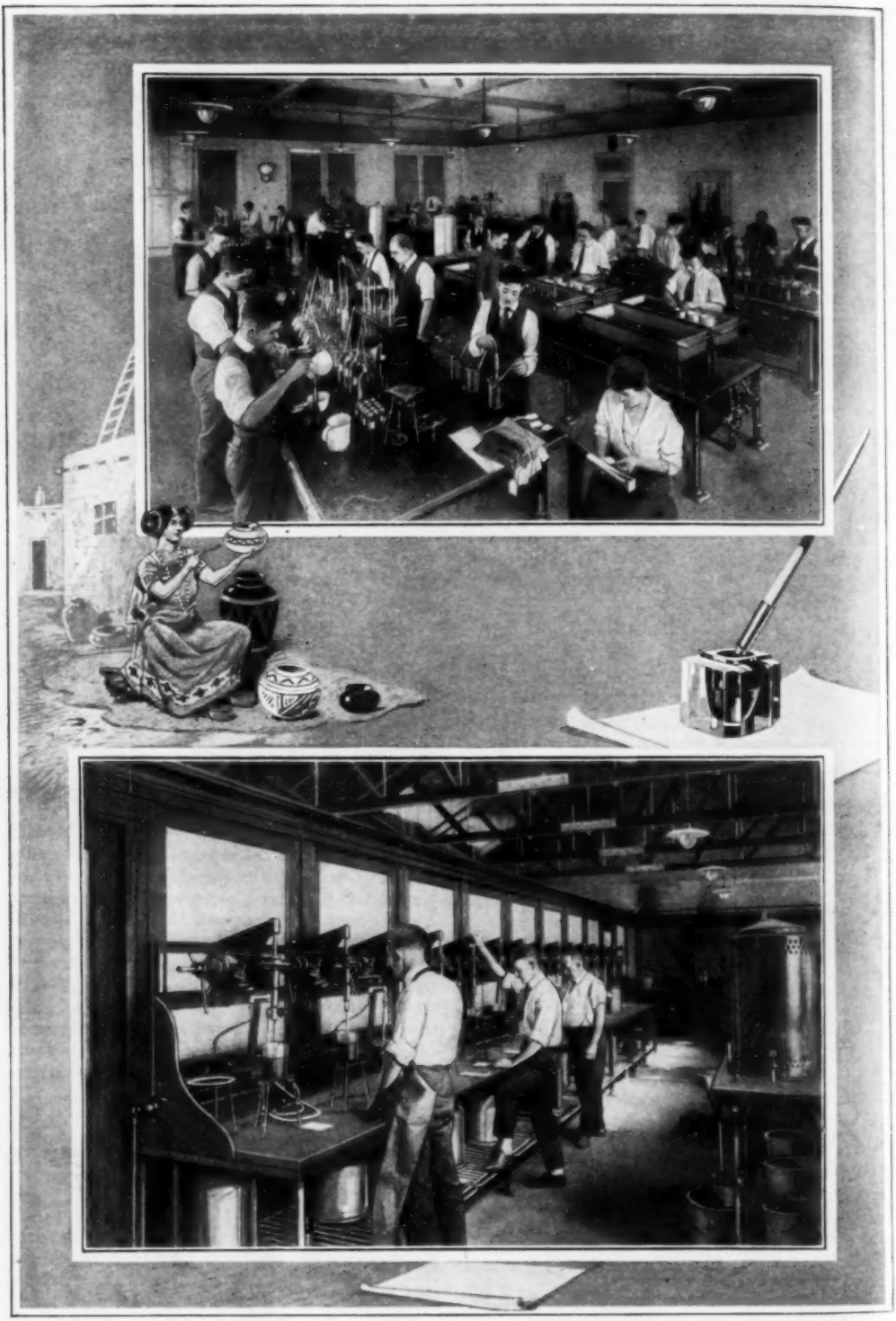
entist. By recording the two forces, an estimate of the power necessary to attain certain speeds with different types of cars can be reached, it is thought. The amount of gasoline being fed to the motor also is shown. It is believed that results of the tests may lead to changes in designs of automobiles and highways to save power.

SOUNDS MADE BY TINY INSECTS CAUGHT IN ELECTRIC "EAR"

Sounds made by small insects generally believed to be absolutely mute, may be heard by a microphone reported to have been completed recently by scientists of an eastern electrical concern. Sounds, heretofore too faint to be caught by the human ear, are said to be recorded by the device which registers the waves as they disturb a delicate current passing between contacts in an insulated ring. Experts claim that the apparatus may be of great advantage in the study of insect life.

MORE POWERFUL X-RAY TUBE TO AID WAR ON CANCER

To reduce the cost of treatment and increase its effectiveness, an X-ray tube has been invented which is said to radiate five or six times as many curative rays as ordinary tubes. Thus the time of exposure is cut down. Another process is being perfected to extend the use of the X-rays to internal cancer.



Laboratories for Testing Dyes (Top) and Paints and Ink (Bottom); Upon the Skill of the Workers Depends the Fastness and Beauty of the Colors in the Finished Product

AMERICA'S SUPREMACY IN DYES IS PREDICTED

Whenever you see any cloth, paper or leather with color upon it you may know that it has resulted from almost countless tests, as the making of dyes is a comparatively new industry in America, having been founded after the war cut off supplies from Europe. Chemists then became interested in the work, and the turning out of colors was started on a larger scale than had ever been possible before.

From 1918, various legislative devices kept out the foreign dyes until the passage of the tariff bill in 1922, which ensured a stability to the industry for some years to come. This has been regarded largely as a measure of national defense, for, theoretically, every chemical plant manufacturing dyes is a potential center for turning out munitions.

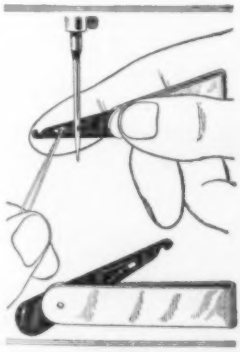
One of the largest manufacturers maintains a laboratory in New Jersey in which research work is handled. Here the company helps in working out coloring problems. When the consumer requires shades to be matched, the laboratory makes trial tests on samples of his material run through a machine which is a model of his own factory equipment.

Then there is an experimental dye house fitted with all the machinery used in all classes of textile mills. These machines are not full size, but are practical working models. Calico printing machines make it possible to do extensive research work in textile-printing problems. Yarns are prepared, wound and weighed for dye-testing in another room.

America's supremacy in the industry is a matter of only a few years, declares Prof. J. H. James, of the Carnegie Institute of Technology. "This probability," he says, "is evidenced by the fact that the United States now produces about 93.5 per cent of the dyes it consumes."

According to his figures there were, in 1914, only seven American firms that manufactured a total of 6,619,729 pounds valued at $2,470,096. In 1922, the sales of eighty-seven American firms totaled 69,107,105 pounds, valued at $41,463,790.

NEEDLE THREADER FOLDS UP LIKE A POCKET KNIFE



Needles of various sizes can be threaded quickly by a small device recently placed on the market. It has two thin steel blades with hook-like points, a larger one from which the smaller extends, for use on darning or sewing-machine needles. After a blade is inserted in the eye, the thread is passed over the hook and pulled through as the point is withdrawn.

LIGHTHOUSE LAMP SHEDS RAYS NINETY-FIVE MILES

Shot from a revolving lantern with lenses so adjusted that the 1,167,000 candlepower beam will have a luminous range of 90 to 95 miles, rays from the lighthouse beacon on Eclipse Island, off the southwestern coast of Australia, will sweep their protecting banners across the heavens to guard shipping. Delicate clockwork mechanism, driven by a falling weight, has been devised to turn the giant pedestal which holds the lights. The revolving part weighs approximately 7,720 pounds and "floats" on 386 pounds of mercury to decrease friction to a minimum.

Giant Revolving Lighthouse Lamp: Part of Turning Apparatus Is in Box at Right

Wicker-Work Case for Grandfather's Clock that Required Nine Months of Basket-Weaver's Labor

WICKER-WORK CASE FOR CLOCK WOVEN IN NINE MONTHS

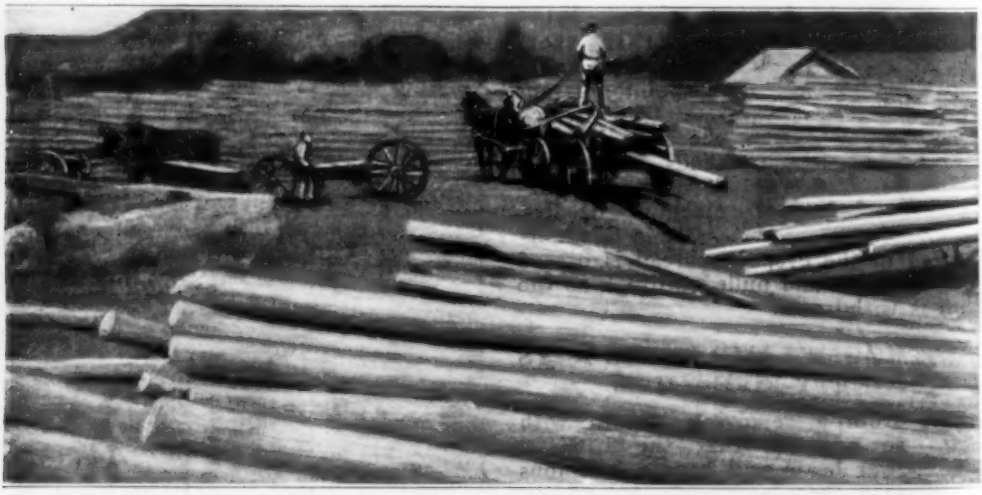
Done in basket work, of the finest and whitest willow reeds, a case for a grandfather's clock was shown at an exhibit recently held in England. The design is simple but attractive. Small towers rise beside the base, and ornamental weaving, that resembles hand embroidery, surrounds the face of the timepiece. This wicker cabinet is over seven feet high, and is said to be a remarkable specimen of the basket-weaver's art.

NAVEL-ORANGE CROP TRACED BACK TO TWENTY TREES

Started in 1870 from twenty trees brought to this country from Brazil for experimental purposes, the navel-orange crop in California now exceeds 8,000,000 boxes annually. The original planting was done under the department of agriculture. Two of the "pioneer trees" are said to be still alive, one in Washington, D. C., and the other in California.

CUTTING WOOD TO MINE COAL TAXES FORESTS

Supplying the hard coal mines in Pennsylvania and other sections with timbering, has so nearly exhausted the supply of near-by wood that material is being brought from the Pacific Coast for this purpose. It is estimated that for every ton of anthracite mined, seventy cents is spent for lumber to make the shafts safe for further digging and to prevent cave-ins. Approximately 500,000,000 board feet of timber are required each year in the mines of Pennsylvania. So extensive has the cutting become in woods near the mining districts that the state forestry department has undertaken large cultivation and conservation projects.



Hauling Timbering Props into Large Storage Yard near Anthracite Coal Mine where They Will Be Cut, Measured and Kept Until Needed for Protecting the Mine Shafts

LAMP IS LIGHTED BY WIRELESS TRANSMISSION OF POWER

Just a glimpse of the future possibilities of the wireless transmission of power was given in the east recently, when an ordinary 110-volt incandescent lamp was lighted while being held a foot from a vacuum tube containing 2,000,000 cycles of alternating current. A loud speaker lacking a horn was also tested. It was a large disk, about three feet in diameter, and connected by wires and a vacuum tube with the mouthpiece. The device did away with the metallic noise, and proved it could reproduce the voice at almost any magnitude.

AUTO BRAKE EXTENSION PUTS LEVER WITHIN EASY REACH

Clamping over the top of the regular brake lever, an extension handle is being made that tends to end straining, reaching or groping. It works the ratchet automatically and almost without effort. When desired, it may be thrown back out of the way to permit easy and convenient entrance or egress from the driver's side of the car. It is made of heavily enameled steel with a handle of highly polished aluminum.

DIAL ON MILK-BOTTLE COVER GIVES DAY'S ORDER

To give orders to delivery men, a cover guard has been designed for milk bottles with a dial on which are printed various dairy products. A pointer is provided for each item and may be moved to indicate the quantity of the article desired. Placed on an empty container, the driver can transfer it to the fresh bottle after reading its instructions. Made of metal, it can be clamped on the rim of the jar to protect the contents. The face of the scale is guarded by a celluloid front, so that the printing can not be obliterated by rain.

STREET GUIDE IN CARS AIDS PASSENGERS AND CREW

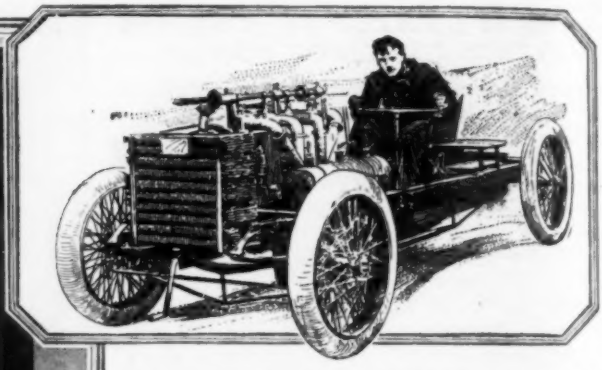
Passengers in surface or elevated cars, subways or steam trains, are furnished a convenient guide and directory and are

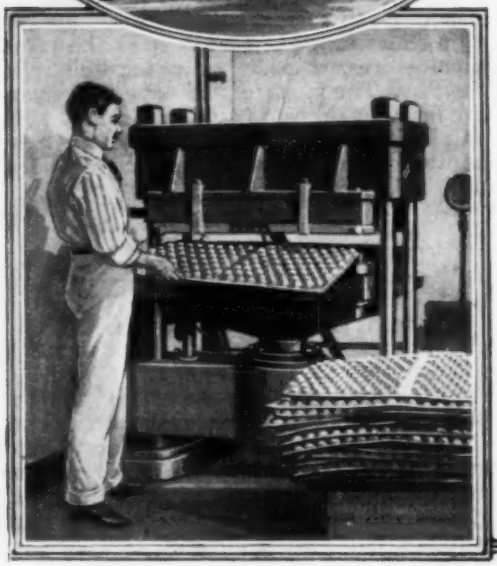
Street-Car Announcer that Shows Approaching Intersections and Principal Buildings by Pushing Button

saved the results of errors and the trouble of asking questions by an electric street announcer. Worked by the motorman or conductor with a push button pressed as the car leaves each intersection, it shows on a printed card within a case, the next street or station. The device is placed at the head of the car or in any conspicuous position. When the button is pressed, a bell rings to attract attention. A legible sign slides into place and shows the principal stores, theaters or other buildings near by. The mechanism is operated from the lighting circuit, is quickly installed, and can be adjusted in a few moments for new routes. It is patented in the United States and in Canada.

TWO MOVIES SHOWN AT ONCE BY USING COLOR SCHEME

By means of colored glasses, the motion-picture patron will be given an opportunity to discriminate between two pictures shown simultaneously, according to the predictions of Prof. F. A. Osborne, of the University of Washington. Separate pictures in differing colors are to be shown on the same screen, it is said, and the glasses will serve to completely efface one while permitting the observer to view the picture he chooses of the performance.





EVENTS OF TWENTY YEARS AGO FROM THE COLUMNS OF POPULAR MECHANICS

TWENTY years ago, the editor of this magazine found the record of events of the day one for astonishment, as indeed it was. Mme. and M. Curie's radium finds were beginning to be noised about in the workaday world, although they had been known for more than five years to scientists. The now familiar automatic magazine pistol had been on the market but a few weeks, and yet had earned the title of "the most deadly weapon known."

Santos Dumont, the aeronaut, had just found his first real competitors in the persons of the Labaudy brothers who flew over Paris in a "remarkable" new airship. A horseless street sweeper engaged the attention of doubtfully minded civic workers. The last spike in the Ogden-Lucin "cut-off," the huge permanent trestle across the mysterious Great Salt Lake, had just been driven by the executives of the Union Pacific railroad and Edward H. Harriman's "great sink hole" of millions in money had been proved worth while.

A writing-pad arrangement for attachment to telephones caused favorable comment. The first sleeping car on an electric railroad had been but recently put into service. A house built on a turntable so that it would always face the sun was eagerly endorsed in France. The Eiffel Tower, known all over the world, was condemned as unsafe—it had begun to lean to one side—and was to have been torn down "at once." It was, however, strengthened by engineers and saved to the world.

The pictures show a racing automobile, one of the first vacuum cleaners, a locomotive with an observation seat in front and the making of ping-pong balls.

NON-SKIDDING AUTO MOVES IN ANY DIRECTION

To prevent dangerous skidding, a four-wheel drive automobile has been designed in England. Behind the gear box is a unit called the distributor, containing a differential through which the power is transmitted through four shafts. Each wheel is connected to the frame by independent cantilever springs. In a test on a grassy slope on which the gradient was about one in four, the chassis was driven in a circle over the ruts and bumps at a speed of from ten to twenty miles an hour. The springs took up all the shock and no skidding was noted, although the turf was damp and slippery. A demonstration also was given of the crab-steering effect. By shifting a lever, the front and rear wheels were made to move inward or outward together, instead of in opposite directions. This enabled the car to move bodily sideways. It was claimed that this ability would be of service in parking in congested traffic.

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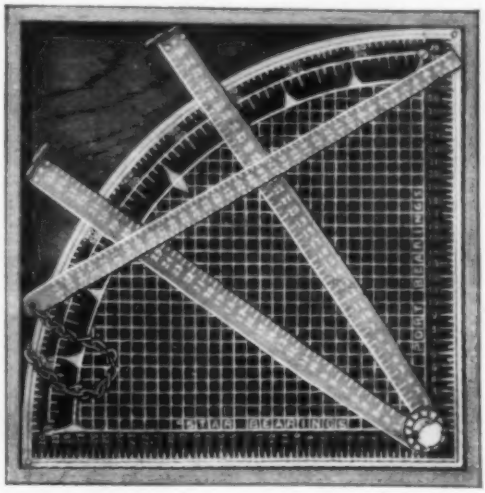
Automobile that Drives, Brakes and Steers from All Four Wheels and Is Able to Turn About in Its Own Length and Travel Sideways Like a Crab

SHIP'S FINDER GIVES DISTANCE OF ANY OBJECT AT SEA

For the use of navigators in making quick and accurate estimates of distances, taking the ship's bearings and plotting the course, a device which combines the common purposes of a sextant and bearing finder has been perfected by a western inventor. It is a flat, figured board with adjustable rule arms and a measuring rod so arranged that when it is placed parallel to the ship's keel, the arms give readings in minutes or miles. It is said to be helpful to pilots on coastwise or lake vessels.



Navigator's Bearing Finder for Computing Sea Distances with Measuring Squares and Ruled Arms

¶ Electric lights suspended over the water in fish hatcheries have been found of aid in feeding the fish. Thousands of insects attracted by the brilliant rays, fall into the hatching tubs or are snapped out of the air by the hungry young fish.

Fresh Fruits for Every Day of the Year

Discovery of Methods of Preserving Without Cooking and System of Drying to Save Growers Millions Yearly

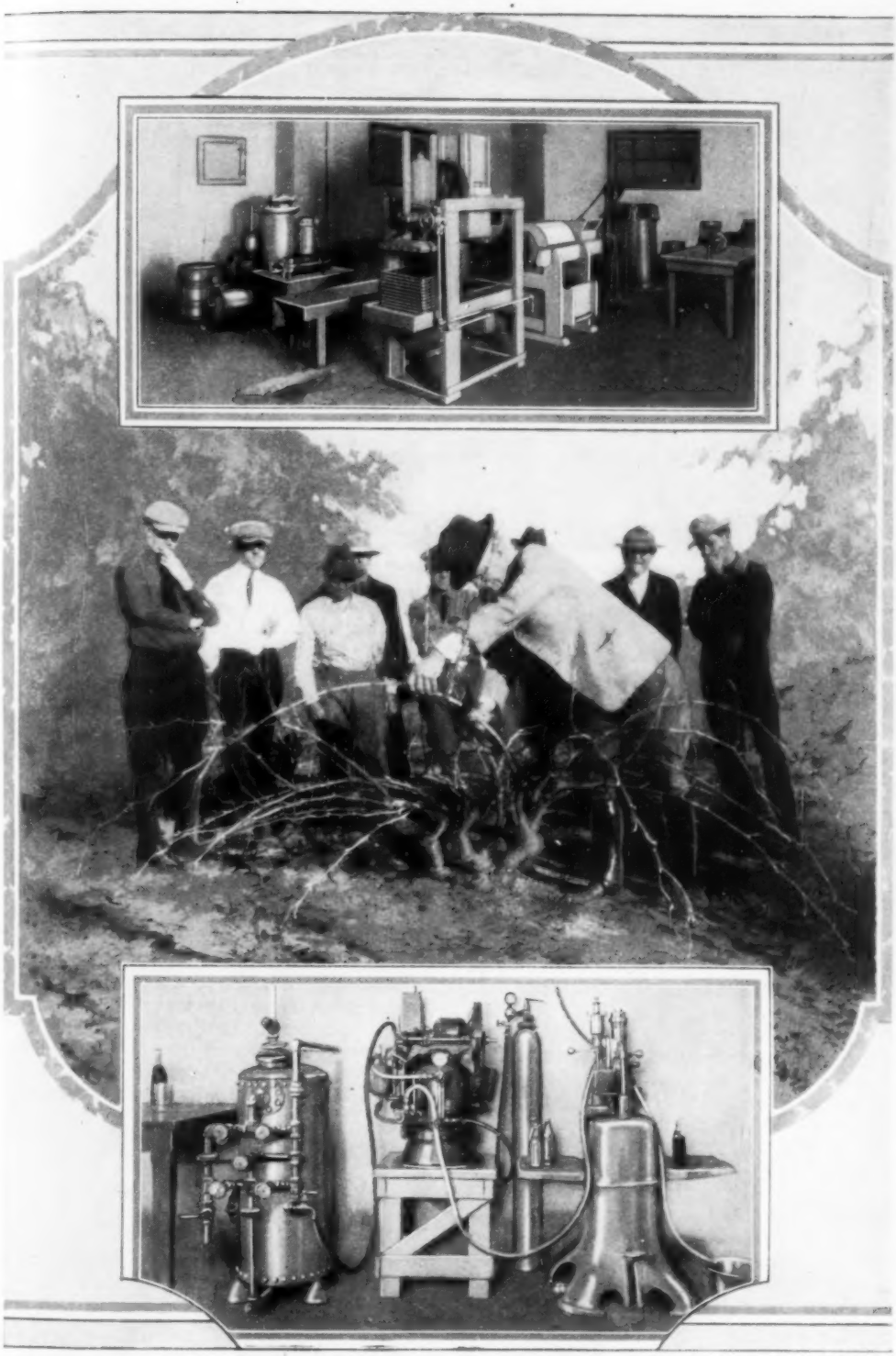
RESIDENTS of London, Timbuktu or any other place in the world which can be reached by a pack train or an airplane, may now have grapes from the slopes of Vesuvius or the valleys of the San Joaquin; peaches from Mount Hymettus or the hills of New Jersey, or bananas from the Honduran jungles, just as fresh on the day they eat them as when plucked from the tree or the vine. These fruits, too, with the exception of the grapes, may be sent dried, so that when water is applied, they resume a shape and appearance very near to that they bore when first picked, with undiminished flavor.

This is the result of more than 1,000 experiments, conducted during the past five years, by the professors and pupils of the college of agriculture of the University of California, led by Professors F. T. Bioletti, A. W. Christie, E. L. Overholser, and W. V. Cruess, all of the faculty. Their discoveries are free to the world, and already are being used commercially.

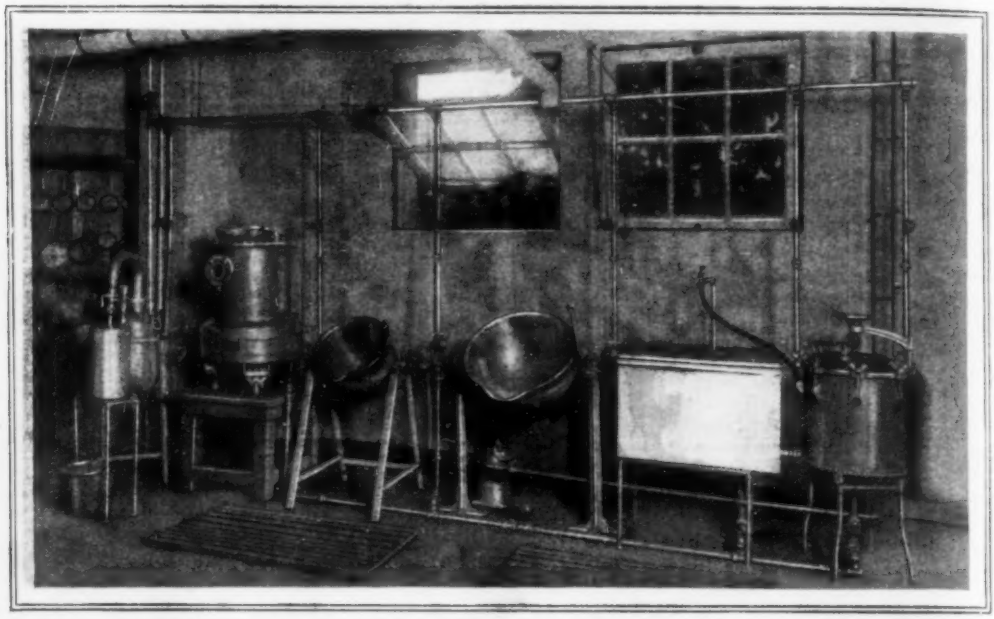
With the students working under them these men have discovered that grapes may be packed and kept for sixty to ninety days and still be as fresh as when picked. They have found a method whereby fruit may be packed without cooking, in airtight containers, and kept indefinitely at low temperature, so that when it is unpacked it will be in the same condition, have the same appearance, and retain the same flavor as when it was packed. They have discovered a system of drying fresh fruits and certain vegetables, whereby these products will resume very nearly their normal, fresh appearance and all their original flavor, when soaked in water. They have originated a process by which fresh-fruit juices may be bottled, put away and forgotten until they are wanted, when they will be found to be exactly the same in consistency, condition and flavor as when they were expressed from the grape or the peach, the pear, the pineapple or any other fruit.

It is estimated that more than $10,000,000 will be added to the value of the annual grape crop of California by the new method of packing and shipping fresh grapes and the making of juice which remains fresh, unadulterated and unfermented. White figs, probably the most perishable of all fruits, handled in the same manner as the grapes, have been laid down in New York, twenty days by sea from San Francisco, as finely flavored as when picked at Fresno, some 200 miles inland. The heaviest loss borne by growers of all kinds of fruits in all parts of the world is due to the time in shipment, and the damage wrought during transit. By these discoveries in fruit preservation without cooking, this loss is reduced to a minimum, and the problem of the grower reduced to that of finding a market, regardless of time required in shipment. Like most discoveries, the methods by which these results are accomplished are simple, require little equipment, and that is inexpensive, in fact, virtually all of it can be built at home. Grapes which have been kept packed seventy days before being opened, and probably could have been kept much longer—are packed in bunches, as they come from the vines, in airtight kegs. A small opening is left at one end of the keg for the escape of air, and through another opening is pumped sulphurous acid,

Sealing Cans of Fresh and Uncooked Fruit to Be Preserved by Keeping Them at Low Temperature



Heating Appliances Used in Search for Method of Preserving Fresh Fruits without Cooking (Top); Experiment in Grapevine Pruning, and (Bottom) Corner of University Laboratory



Apparatus Devised by the Faculty and Students of the College of Agriculture of the University of California in Their Discovery of Method of Preserving Fresh-Fruit Juices

which is a gas, until it has expelled all the air from the keg. The opening is then sealed hermetically, additional pressure put on the supply of sulphurous acid, and in a few seconds, the gas tube is withdrawn and that opening also sealed airtight.

No refrigeration of any kind is required and figs also have been shipped successfully in this manner, while experiments are now being conducted on perishable vegetables. The explanation of the grape-packing method is contained in the fact that the sulphurous acid keeps the skins of the grapes disinfected and free from the bacillus of decay, which cannot develop in the absence of oxygen.

The preservation of perishable fruits in airtight packages also has been accomplished this year in still another manner, of even greater value commercially. They are prepared and washed as if for immediate use, and packed into ordinary tin cans, a light sugar syrup is added, filling the cans to the exclusion of all air, and the cans hermetically sealed. These cans are then stored in a refrigerating plant or ice-box where the temperature is about twenty degrees Fahrenheit. This freezes the fruit. When thawed out, it retains its original flavor, freshness, size, shape and color for at least twenty-four hours.

Still another method of preserving for long-time shipment and distant use has been discovered in a new form of drying, whereby all the water, and nothing but the water, is removed. This dehydrated fruit, if kept free from insect pests, will remain in good condition indefinitely. When wanted for use, water is added and in a few moments the fruit begins to swell and to take on something of the appearance it had when fresh. Naturally, this fruit is intended for cooking, and not for table use. The great value of this dehydration discovery lies in the fact that the fruit can be shipped, packed in insect-proof paper or wood packages without refrigeration.

The fourth and last of these discoveries in the preservation of fruits without cooking for long periods comes with the announcement from the same workers that fresh-fruit juices may be kept indefinitely by a new method of bottling. This is largely a commercial proposition, since the expense of the equipment necessary to successful bottling is rather too expensive for individual or even family use.

ACID-PROOF INK WON'T STAIN

Containing substances which combine with the paper to which it is applied to form an indelible compound, an ink is being made which will wash easily from the clothing or hands. It will work in fountain pens, as it does not clog and will not corrode steel or form sediment or "gum" in inkwells.

WARN PUBLIC OF COUNTERFEIT TEN-DOLLAR NOTES

Thousands of dollars' worth of counterfeit $10 Federal Reserve Bank Notes were added to the account of spurious money recently. This last series, all purporting to be from the Chicago branch and bearing the numbers G-56637764A, G-56637746A, and G-56636744A, are so cleverly made as to mislead even experienced bank tellers. The notes bear the picture of Andrew Jackson and the number D-333 under the seal on the face of the note. On the reverse side they are off-color, having either a lighter or darker shade of green than the genuine bill. The threads of silk, as appearing in the genuine notes, are simulated in the counterfeit by printed lines. The lines cannot be seen when the counterfeit is held to the light.

EVERY STREET IN CITY SHOWN ON BRONZE TABLET

Inscribed with a plan of the streets and principal highways of Berlin, a circular bronze tablet resting on a stone base in Potsdam Place, in the German capital, is an ever-ready guide to visitors. Points of the compass, important buildings and centers, and other information that will help strangers to find their way about, are

Bronze Tablet Inscribed with Plan of Berlin Streets Conveniently Located at Busy Corner

engraved on the durable surface of this accurate "information bureau."

For measuring the depth of water in wells, an Australian inventor has perfected an electrical device which can be carried in a coat pocket when not in use.

ELECTRIC SANDER DOES DAY'S WORK IN SINGLE HOUR

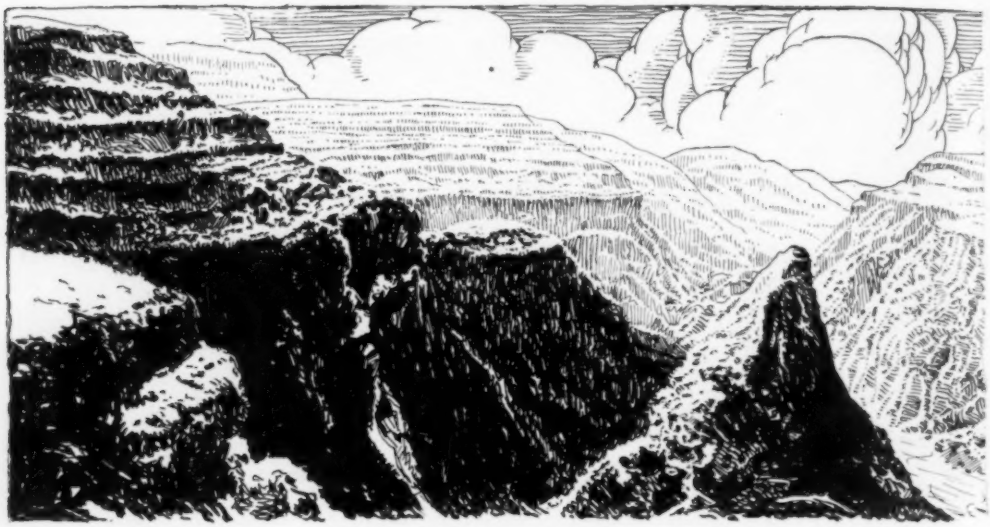
For finishing hardwoods or removing the varnish from old work, a portable, electric

Portable Sander that Also May Be Used on Floors by Attaching It to an Extension Handle

sander has been made which may be used either on the bench or on floors. The depth of the cut may be adjusted by a screw below the handle. Rollers guide the sand drum at the proper angle for the fastest and smoothest cutting. When used on floors it is attached to an extension handle. The motor is driven by current from any light socket. It is claimed that the device will do in an hour work that would ordinarily require a full day.

EVERY STOP OR START OF AUTO IS RECORDED BY DIAL

Recording in miles and minutes the detailed operations of a motor car for a day of twenty-four hours, a small dial instrument, somewhat like a speedometer, has been put on the market by an English firm. A silver needle records on a sensitized chart by means of V-shaped and straight lines, the automobile's stops and journeys. The dial is turned by a clock-work mechanism and is marked into hours and fractions. It quickly tells the length of a halt and the time it took to go a certain distance. The instrument is securely locked in a waterproof case and is easily attached to the car. It is driven by a flexible shaft geared to the inside of the front wheel.



Surveying Depths of the Grand Canyon

Roughest Three Hundred Miles of the Abyss Are Traversed by Government Party to Obtain Mapping Data

TO locate sites at which dams could be built to utilize the wasting waters for flood prevention, power development, and irrigation, the last stretch of the canyon of the Colorado that had not been surveyed in detail for accurate mapping, has been traversed by a government party in charge of C. H. Birdseye of the geological survey.

In four wooden boats, supplemented by a canvas canoe, the 300-mile journey was made through the roughest waters of the mighty chasm. These boats carried all the supplies of the party and also, except at portages, the men themselves. In addition to the usual instruments used by engineers and geologists, a radio-receiving outfit and complete photographic equipment were taken on the trip.

The start was made from Flagstaff, Ariz., the railroad station nearest to the point of departure, for Lee's Ferry, 140 miles away, with one boat on a motor truck and with all the provisions and instruments on another truck. "A part of the road to Lee's Ferry," said Colonel Birdseye, "was in a frightful condition—so bad that we had to stop every few miles and repair it before we could go along. This stretch of road includes the 'dugway,' a narrow road blasted out of the cliff, which at some places rises about 300 feet above the river, and the job of steering a heavy truck laden with an 18-foot boat around the perilous turns lent lively interest to the journey."

About two weeks were spent under the stress and distress of a temperature that reached 110 degrees in the shade nearly every day, in making new topographic surveys. Starting down the canyon, the party camped at the head of Badger Creek rapids, seven and one-half miles below Lee's Ferry. Here the radio set was tried out, and in spite of adverse prophecies that a radio set could get nothing in the depths, Los Angeles was heard plainly, although the gorge here is 1,000 feet deep. From this point down the canyon the radio outfit was set up from place to place and received messages from Los Angeles, Salt Lake City, San Francisco, and on one occasion from Colorado Springs. Badger Creek rapids were run by the four wooden boats, the canvas canoe being portaged. These falls have a drop of thirteen feet in about a hundred yards, and they looked wild enough, although later experiences with rough water farther downstream made them seem in memory altogether tame. Even in this venture, however, the first boat through the rapids struck a rock with such force that a hole was knocked in its bottom.

Then the party portaged the boats and equipment past Soap Creek rapids, carry-

Downstream View of Upper Granite Gorge

ing and skidding them for about a hundred yards over the rocks into an eddy below the worst part of the stream. The boats were reloaded in this eddy and then run safely through the lower part of the rapids. These rapids have never been safely run by any other party. "It was man-killing work," said Colonel Birdseye, "to portage the heavy wooden boats here. Perhaps we might have got through safely without portage, as we ran worse rapids later, but it did not seem wise to take the chance so early in the trip.

"The next day," said Colonel Birdseye, "we reached a rapid that lay between vertical cliffs which rose directly from the water, so that there was no foothold for portage and no chance even to look the rapids over and form a plan to run them. We called them 'Sheer-wall rapids,' but we ran them safely, though everybody got wet. We put on life jackets and lay face down in the boats, clinging hard to the life lines that were stretched across the deck. The waves seemed mountainous, and to some of us our first ride of this kind was a genuine thriller, but we afterward became so used to riding rough water and getting soaked that we vied with one another to make the plunge with a lighted pipe or cigarette without losing the light."

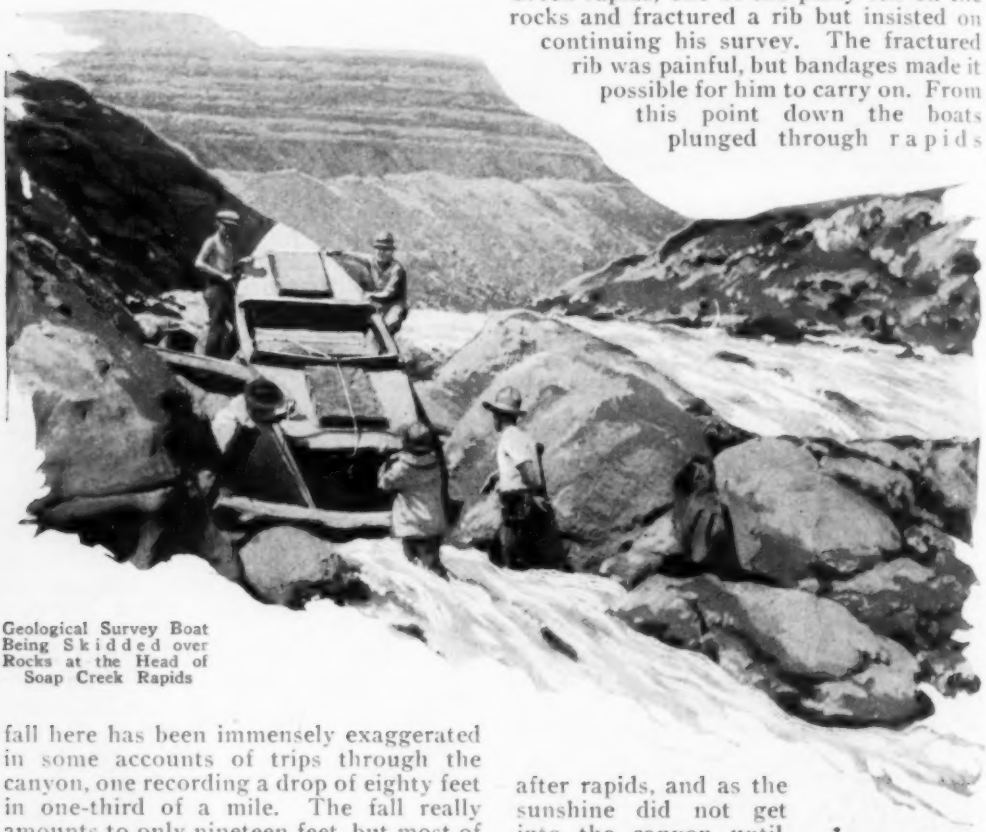
Amid the excitement of running rapids and of the boatmen's dare-devil defiance of the swirling waters of the canyon, the scientific members of the party never for a moment forgot the main purposes of the expedition. At necessary places the surveying instruments were set up, photographs were taken, and calculations were made in furtherance of the larger ends in view. The canvas canoe was lost in an attempt to "line" it around Spring Cave rapids, that is, to drag it by means of lines attached to the bow and stern. The canoe might have run safely through the rapids, for the fall is only about five feet, but the waves were breaking high and were discouraging.

After several other rapids had been run, the boats passed Vasey's Paradise, thirty-one miles below Lee's Ferry, so named by Maj. J. W. Powell, the first explorer of the canyon, in honor of George Vasey, a botanist. Here a large stream of clear, cold water gushes from the cliff about seventy feet above the river. The party filled their canteens, explored a large cave, made surveys of a possible dam site, and camped on the limestone ledges, where radio messages were received. About forty-one miles below Lee's Ferry, some fine arches in the limestone wall of the so-called Marble canyon were passed. Here the walls, which rise sheer about 2,000 feet above the river, have been sculptured into wonderful forms by erosion and by the fall of great masses of rock.

The next day the boatmen ran the little fleet through Boulder rapids, and the rest of the party picked their way along the banks. Blake, one of the boatmen, was thrown out, turning a complete somersault and going out of sight, but he soon reappeared and caught his craft, which had not overturned, climbed in, and paddled on. One night the river rose three feet and

the party had to rouse themselves and hustle to pull up the boats. A voyager in the canyon always has reason to fear a rise in the river, particularly at night. A boat swamped or carried away means the loss of provisions and equipment, and even the lives of the men may be endangered if they are caught in a narrow box canyon where the walls are sheer and afford no foothold.

The dreaded Sockdologer rapids, seventeen miles below the Little Colorado, was the next big obstacle. The height of the fall here has been immensely exaggerated in some accounts of trips through the canyon, one recording a drop of eighty feet in one-third of a mile. The fall really amounts to only nineteen feet, but most of it occurs in the first hundred yards. The waves have been described as thirty feet high, but they measured in fact only about twenty feet from trough to crest.



Geological Survey Boat Being Skidded over Rocks at the Head of Soap Creek Rapids

It is impossible to climb around these rapids, so all had to take the boats. Seen from above the rapids, the first boat and its passengers were glimpsed only at intervals; they were out of sight most of the time, but they finally appeared at the foot of the rapids right side up, and when the semaphore signals sent back O. K. to the rest of the party, everyone felt relieved. The next morning, the boats plunged into Grapevine rapids, which has a fall of seventeen feet in a few hundred yards and is full of rocks. At this place it is impossible to climb around the rapids, so the whole party shot through in the boats. The river had been rather high, and though the high water makes larger waves, eddies and whirlpools, it helps to keep the boats off the rocks and so perhaps makes the plunge safer. Between all these perilous plunges down dangerous cataracts the surveyors carried along their work.

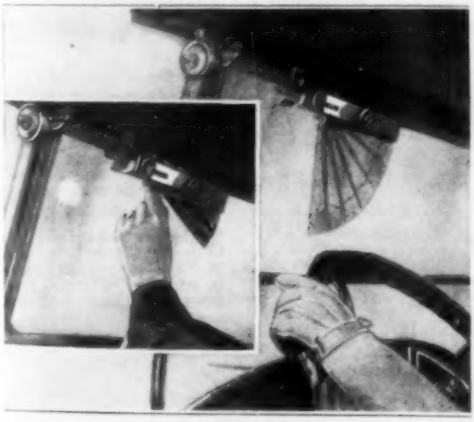
When the boats plunged into Diamond Creek rapids, one of the party fell on the rocks and fractured a rib but insisted on continuing his survey. The fractured rib was painful, but bandages made it possible for him to carry on. From this point down the boats plunged through rapids after rapids, and as the sunshine did not get into the canyon until late in the morning, the first half of the day was chilly. The rapids have a fall of nearly twenty feet and look dangerous, and the sheer walls leave no chance to pass around them, so everyone had to ride in the boats. Three boatmen ran their crafts safely, but the deck loads made the boats top-heavy and caused them to dance about in the torrent like corks even after the cockpits were filled with water. The huge waves tossed one boat into the air, and when it came down, bottom side up, the passengers were thrown out and narrowly escaped being crushed by the rocks.

RUBBER BALLOONS IN GAS MAIN CONQUER FLAMING VOLCANO

When gas, escaping through a manhole in the street from a twenty-inch main, was ignited by the backfire from an automobile, the engineers of the Peoples' Gas Light and Coke company, of Chicago, faced a difficult problem. As the main fed a busy manufacturing district, it was necessary to conquer the flames without interrupting service. Fire engines were called to the spot and several streams of water were directed at the fronts of surrounding buildings, while workers at a safe distance dug down to the main at each side of the leak, which was caused by corrosion. Then four-inch holes were bored into the pipe and through these openings large rubber bags, attached to long tubes, were inserted. Air was pumped into the bags, effectively blocking further passage of the gas. After the flames had subsided, the break was repaired, the bags removed and the holes plugged without an instant's interruption of service.

GLARE SHIELD FOR AUTO FOLDS LIKE BLADES OF FAN

To guard the eyes of an automobile driver from glare, a protector that folds up like a fan is being made for fastening to the windshield. Simply turning a ring on

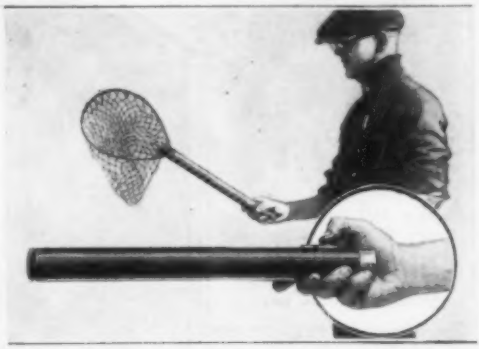


Fanlike Glare Shield which Is Easily Adjusted or May Be Folded Back in Case

the device causes it to spread a green curtain over a section of the glass, leaving space for the motorist clearly to see the side of the road. When not required, the mask can be closed into its metal case by another twist of the handle. Use of the glare shield is said to eliminate the need for heavy colored goggles during the day.

AUTOMATIC FISH LANDING NET OPENS AT SINGLE TOUCH

Inclosed in a small round barrel, a landing net that opens at the touch of a button has been invented for the convenience of

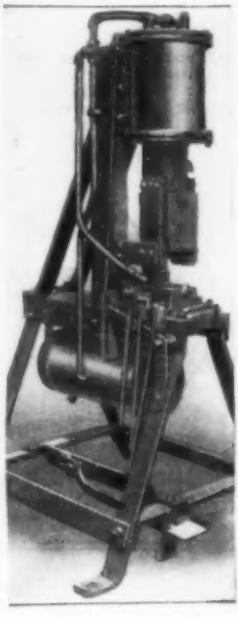


Landing Net and Carrying Case from which It Is Released by the Touch of a Button

sportsmen. It is entirely encased when not in use and can be carried in the belt or slipped into the pocket. A spring forces the bow on which the mesh is suspended out of the casing ready for action. When folded the holder is thirteen inches long. All metal parts are rustproof. The net saves space in the camping outfit and in the boat, and does not get torn or entangled with other things when not in use.

AIR HAMMER TAKES BENDS FROM OLD RAIL SPIKES

Old railroad spikes made worthless by being bent are reclaimed by an automatic straightening machine built by a western railway. The apparatus takes the crooks out after the nails have been heated in an oil furnace. As each piece is laid under a compressed air hammer, another is fed into the other side of the device. More than 2,000 spikes are treated in a day and, it is said, the operation has resulted in a great saving of materials.



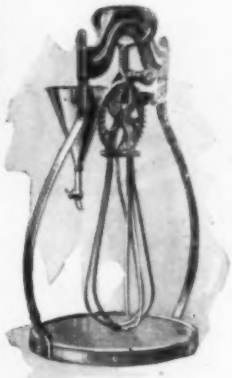
Time and Money-Saving Tools

Tester Which Quickly Tells Whether Egg Is Good or Bad by Light Shining through Shell on Mirror that Can Be Seen through Hole in Base

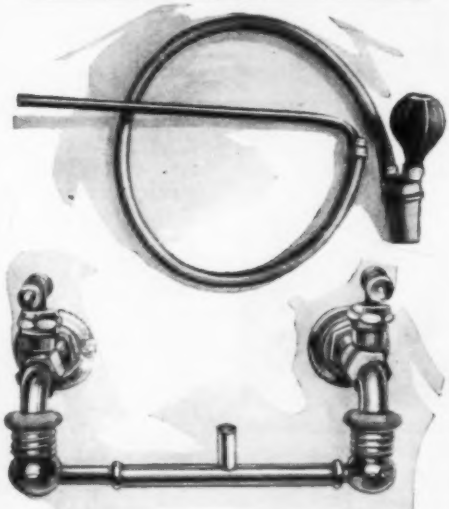
Pocket Comb that Is Made in Two Sections, One with Fine Teeth and the Other with Coarse; when Open, It Extends Six Inches; after Being Folded, It Occupies Only Half This Space

All the Thrills of a Toboggan and Swing Are Combined in This "Whizzer" Designed to Keep Children at Play in Their Own Yard

Turning Any Vase into an Attractive, Portable, Electric Light Is Possible with an Adapter that Carries the Socket for the Lamp on a Patented Grip inside of the Neck

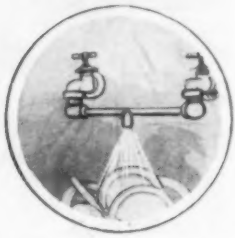


Egg Beater for Making Mayonnaise Sauce with an Automatic Drip to Add the Oil as It Is Needed Without Touching with the Hands



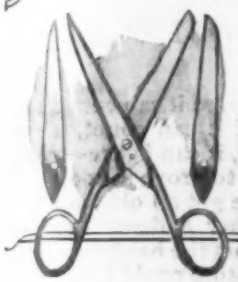
Filter and Mixer that Regulates Temperature of Water and May Be Used to Clean Bottles (Left) or Wash Dishes (Right), and Is Attached to Faucets with Rubber Elbows

To Insure Pure Drinking Water, a Simple Filter and Siphon Have Been Combined, the Flow Being Started by Bulb Pressure



Anyone wishing further information on devices described in the editorial pages can

for Woman's Workshop in Home

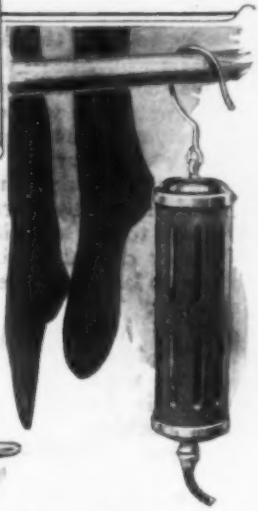


Scissors with Detachable, Razor Steel Edged Blades Which, When Dull, May Be Replaced Quickly and Easily and at Trifling Cost

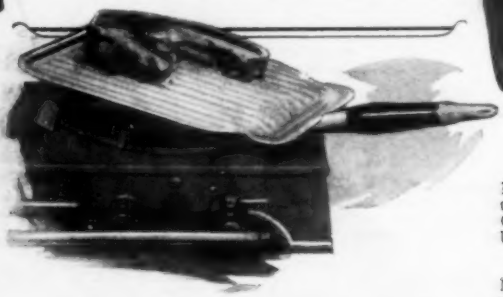
Can Opener Especially Designed for Campers and Boy Scouts, that Can Be Folded Flat and Carried on a Key Ring

Seat, Foot, Shower and Child's Bath Combined in One Tub that Requires Less Water and Yet Provides Ample Space When Standing or Sitting

Sharpener for Fiber Phonograph Needles that Operates Without Removing the Points from the Tone Arm and at the Touch of a Lever

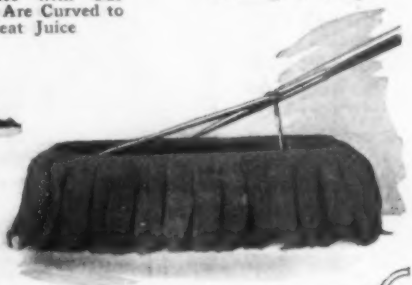


Portable Electric Heater that Can Be Hung in Closets or Cupboards or Used to Dry Laundry Air



Steak Grill Attached to Handle that Is of Service with Gas Stoves; the Edges Are Curved to Catch the Meat Juice

Mop Made of Swan Skin with the Down Still on It that Is of Service in Cleaning Statuary



Fastener that Quickly Attaches Handle to Broom or Mop; This Permits the Use of Any Length of Stick So that Difficult Spots on the Walls or Ceiling May Be Reached; the Device Consists of Steel Jaws Operated by a Spring

obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago

Making the Mechanical Mathematician

Watching the Ratchet Wheel on Planer Results in Invention That Is Now Sold in All Parts of the World

JUST forty years ago a stocky young mechanic was toiling over his planer and filling an oily yard of heavy wrapping paper with figures and drawings during his spare time.

Fascinated by the busy little wheel which automatically adjusted the cutting edge of the tool, he became imbued with the idea that the ratchet could be turned into a counting machine. To do this, he figured, he need only number the notches on the wheel and then put more numbered wheels beside it. Then by making each wheel turn ten notches, or one complete revolution, in order to turn the next wheel a single notch, he would have solved the problem.

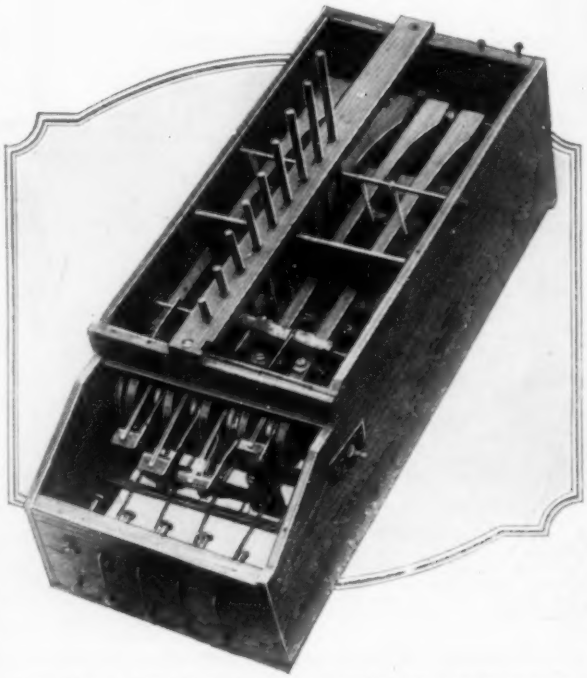
It was a long step from that ratchet to a machine which would actually calculate—an adventurous step that called for planning and figuring. Hence the yard of wrapping paper and the stub pencil used so industriously by Dorr Eugene Felt. But he clung to his one idea, and the shop hopelessly classified him as an inventive "nut" who lacked the redeeming feature of versatility. To him the idea of an adding machine was original—he knew nothing of the attempts, and failures, which had preceded his efforts. And he probably would not have cared, if he had.

Opposition and ridicule? He thrived on them. He would just grin and keep on figuring and experimenting. On rare occasions he would warm to the subject, and then he would say: "That little ratchet wheel can feed my planer tool, can't it? And I've proved it can count, too, haven't I? Well; if it can count, it can add, and if it can add, it can figure—calculate. And I'm going to prove it, too!"

From the grocer he got an old macaroni box, from the butcher a dozen wooden meat skewers, and from the hardware store some staples. That store could furnish no springs that he could use, so he resorted to rubber bands as their substitute. So he went to work, a jackknife and a screwdriver being his principal tools.

This adding machine was no marvel. It worked, after a fashion, but not the way it would have to in order to be used as a demonstrator. Such a model must be made of metal—properly constructed. That meant money, and the young inventor had no money, but he obtained a loan from the proprietor of the shop.

Finally the finished model was ready for demonstration. It proved an unqualified success. The mechanical calculator was an accomplished fact. Capital was ready to back him now. He accepted just enough to cover his barest needs, not enough to menace his control, put himself on a salary of $20 a week, and figured to work fourteen hours a day.



First Model of Mechanical Calculator Which Was Made Out of a Macaroni Box

That year the young mechanic-inventor turned out seven machines. Then he was made president of the firm which was organized to make and sell machines, and under his guidance this company has prospered until today its product is sold in every civilized country in the world.

ART OF GOLDSMITHS UNCHANGED IN CENTURY

Skilled goldsmiths, with the simple tools of their craft that were in use more than a century ago, demonstrated their cunning recently in preparing gold covering for the gates and railings in Buckingham Palace. Swinging hand mallets that weighed from 12 to 21 pounds, they pounded out practically pure gold into thin sheets of foil, so thin that an ounce

of the precious metal covered 200 square feet of surface. The hammers are swung with precision and have broad heads to avoid tearing and bruising the thin sheets. Starting with small blocks or bricks of gold molded from molten metal prepared in retorts, the workers pound with such skill that the finished sheets are often 1-282,000th of an inch thick.

Copyright, Keystone View Co.

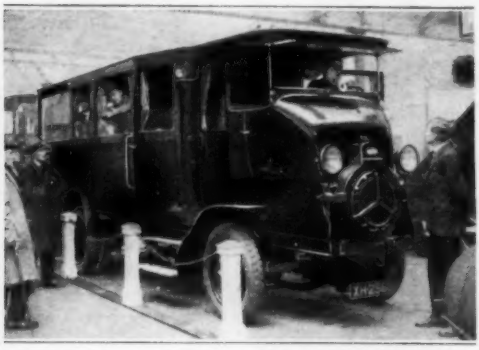
Beating Out Gold Foil Thinner than the Finest Tissue Paper Known: Above, Pouring Molten Metal from Retort into Mold to Form Gold Brick for the Pounders

WEATHERSTRIP IN ROLL STOPS RATTLES AND DRAFTS

Loose, noisy windows and doors that let in wind and dust, are quickly silenced and made practically airtight with lengths of weatherstripping material composed of flexible, rubber-coated fabric that fits tightly to the side of the frames and snugly about all cracks and openings. It is round, like rope, and cannot curl up around the edges and fold back, and comes in coils, the lengths being cut off as desired. On one side is a flap for tacks. It is especially adapted to fit tightly over irregular surfaces such as those of warped doors.

MOTOR BUS LIKE PULLMAN CAR AIDS TOURIST TRAVEL

With parlor-car seats, card tables, and electric stand lights, luxurious motor busses have been put into service for the

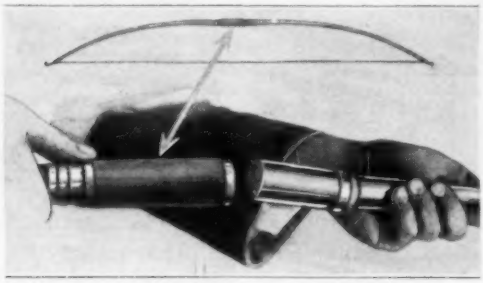


Luxurious Automobile Bus of Type Used in Parts of Europe for Accommodation of Tourists

convenience of tourists in Europe. Vying with the comforts of railway travel, they afford better views of scenery and are scheduled to cover routes that often require six days to complete. The motor coaches also touch many isolated points of interest that cannot be reached by rail. This form of transportation has grown in favor, and the lines are crowded with visitors.

FOLDING ARCHER'S BOW EASIER TO AIM AND TO CARRY

So that it can be quickly taken apart for carrying, an archer's bow, patented by a Massachusetts inventor, joins at the middle in a handle, which is said to make it stronger than ordinary types. When the string is released for a shot, the arrangement is said to give it greater casting force



Folding Archer's Bow and Center Joint that Adds to Its Strength and Accuracy

and to eliminate "kick." A metal cylinder, it is claimed, prevents bending of the center and gives a smooth spring to the arrow as it takes flight, as well as furnishing a resting groove for the shaft. The grip is made to fit the hand of the archer comfortably, thus permitting steady aim. Either half of the device can be renewed.

LOCOMOTIVE IS DRIVEN BY AIR TO PASS THROUGH FLOODS

So it can run safely over flooded tracks, a locomotive has been built in Italy that uses compressed air for power. Tests of the engine are reported to have shown that it can pass through water more than a yard and a half deep, while hauling a train. It is expected the apparatus will be of great advantage in rescue work and transportation of supplies in lowland regions frequently inundated by swollen rivers or storm-swept seas.

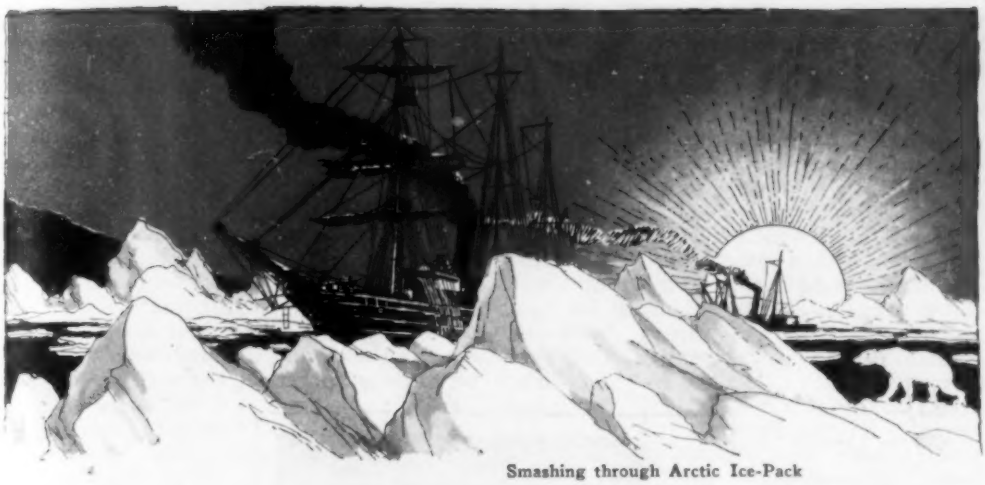
ACCURACY OF LENS IS PROVED QUICKLY BY LIGHT RAYS

For testing lenses manufactured by a German optical concern, a beam of light is thrown from a tube upon a holder in which

Inspecting Newly Ground Lenses with "Testing Glass" that Shows Imperfections as Colored Stripes

a number of the finished pieces are set. When a curved glass plate is placed over them, any imperfect surfaces can be seen, appearing as colored stripes under a magnifying glass. It is believed that this method will save much of the repeated inspections usually necessary to eliminate incorrectly ground lenses. Only a small part of each lot produced, it is said, are fit for installation, the remainder requiring remelting and recutting.

¶Nearly one-third of the entire available water power of the United States is located in the states of Washington, Oregon, and Idaho.



Smashing through Arctic Ice-Pack

Balking Poachers in the Frozen Arctic

U. S. Coast-Guard Cutters Carry White Man's Law Past "Roaring Forties" to Protect Great Seal Herds

NORTH of Point Barrow and the "Roaring Forties" that seamen dread, the coast-guard cutter "Bear" plows into the vast Arctic ice pack. Three-quarters of the world falls away to the south, and all the solid land of which men have knowledge rolls over the shoulder of the globe astern. Each night the Aurora converts into day, and every day is barely long enough for the captain to make an observation.

Above, three masts spread vast wings of gray canvas, scarcely less dark than the smoke which pours from the single stack. In the crosstrees, a lookout signals a flag flying over Nigaluk, behind the barren isles. The bell to the engine room rings, the ship turns slowly toward the blue line which indicates the shore. A black spot develops into a boat, filled with rowers, coming out. The captain puts his glass on the flag. It is a man's coat and a woman's dress, flung to the wind from a high pole. "Storm ahead," he says; "somebody wants to get married."

When the gangway is dropped, a score of fur-clad figures, each one a Santa Claus without the bag of gifts, troop aboard. The leader makes guttural sounds, to which the captain replies. They smile and shake hands, and it develops that two of the figures are female. One of these and one of the men stand in front of the captain who reads a marriage service. They sign a paper, with two white men in the uniforms of Uncle Sam's service as witnesses. Then the other woman and a man step forward. There is an exchange of more gutturals. Another paper is signed. The first man and the first woman cling together; the second pair draw apart.

"One tied and one untied," observes the captain, as he files the marriage papers and the divorce decree in the wall safe. Another man steps forward. His brother is sick. Where? In the boat below. A tackle is dropped and a bundle lifted out of the seagoing canoe. Laid on the table, the man reveals a broken leg. After it is set, splints are bound on, instructions given, bundle lowered back, the boat refills and shoves off.

Darkness thicker than the fog begins to spread over the waters north of 70, and the ship stands out to sea. It has been an easy day for the "Bear," now in her fortieth year spent in carrying the law and the government of the United States into the far north. Built of wood more than half a century ago, this three-masted cutter has won at least one fight each year with ice which annually crushes larger vessels, made of steel, in its world-warping grip. Each year she drags from the ice, crashing with her wooden bow a lane through the ice pack, ships which have delayed too long in leaving the frozen ocean, and patrols the coasts of Uncle Sam's domain from Queen

Charlotte Islands northward, around the Gulf of Alaska, along the steaming Aleutian chain, through Bering Sea, where she stops to hunt down poachers of the seal herds on the Pribilofs, and then on poleward again past towering Nunivak and long St. Lawrence Island.

Touching at Nome, she points northward again, the only white man's law north of the East Cape, with the exception of her sister coast-guard cutter, the "Algonquin." Through Bering Strait, past Point Hope and the Icy Cape, she steams to Point Barrow, the northernmost tip of America's domain in the new world, and sweeps abruptly eastward into the wet and silent desert of the Arctic ocean. Signals greet her, here, there, everywhere. Here she heals the sick and buries the dead; there she picks up a stranded hunter or an explorer; somewhere else she puts down food to carry through the winter a starving group of white men or of Eskimos, for there is no bar of color or condition of race north of Nome. Her captain, Commander Cochrane, carries the power to grant marriages or divorces, to make arrests for any crime against the white man's law, to pass judgment when sitting with his officers in a court, and in flagrant cases, to carry out that judgment, even to the extent of summary execution, for which the swaying yardarm, half a hundred feet above the deck, furnishes the gallows tree.

Executive Staff of the "Bear" Who Represent the United States Government North of Nome

To the "Bear" and her captain is due the fact that the salmon fishing fleets of Seattle and San Francisco, and the whalers of more northern ports come through their seasons year after year without loss of life, for the coast-guard cutters watch over these industries as they watch over the trading schooners, the freighters, the great sailing ships that bend their way by the northward route across the Pacific and into the Arctic every summer. From the time she leaves her winter moorings in San Francisco Bay, in April every year, until she returns late in October, hers is a constant watch. Night and day men search the sea from her decks seeking the good they may do.

Again, the wooden ship moves eastward until Herschel Island lies abeam. Suddenly a light flares out of the darkness, and then another. In what seems less than a moment, answering lights lift from the bridge of the "Bear." There is a short talk in silent flashes through the thickening air. The cutter works her way slowly inshore, as Captain Cochrane studies his charts. At the ultimate point he dares approach the shore in the night, he rings for the full stop. An anchor chain rattles through the hawsepipe, a final signal burns on the bridge, a riding light is swung from the masthead, and the frozen world drops off to sleep, forgetting the perils of the day.

When light lifts it reveals a steel tramp steamer caught in the pack ice, in the channel between the island and the mainland shore. Too much eagerness for trade with the Eskimo has caught her, held her too late, and, if she be not saved, she will be an empty hull, her crew dead from starvation, before the ice breaks in the spring. The "Bear" backs off, her captain studies his charts more closely. Suddenly, in response to a signal from the bridge, the old wooden cutter leaps forward, smashing her nose through the pack ice.

But there are other and less pleasant tasks than performing marriages and rescuing ice-bound ships. In port in Alaska, the captain of the "Bear" receives word that poachers, crossing in schooners from the Asiatic mainland, are preparing to raid one of the fur-seal rookeries. With all sail set and her engines adding to her speed, she immediately starts for the threatened island. Lying below the horizon until night, she silently approaches the refuge of the seal herd. Rifles are distributed to the crew and belts filled with cartridges—for the poachers may fight, run, or submit. There have been many arrests, numberless flights and a few battles, fought up there on the silent sea, with only the barking of myriad seals to furnish background for the rattle of rifles. In every such incident, the "Bear" has been victorious, until today the poachers virtually have abandoned their efforts to loot the fur seals.

Coast-Guard Cutter Protecting Seal Herd in Far North, Preventing Poachers from Russia and Japan from Destroying the Great Rookeries Developed under International Treaties

EXPANDER TELLS LUNG POWER AND ADDS TO STRENGTH

Chest expansion is measured accurately and the amount of air inhaled is shown in cubic inches on a flexible belt with legible

Chest Expander Adjusted: Measurements Are Registered in Opening of Ruled Section

indicator ruled in such a way that the readings are made easily. Slipped over the shoulders and fitted to the chest at normal position, it expands as air is taken into the lungs. The device has proved of special value in taking chest and breathing exercises. Resistance afforded by the spring tension of the belt urges the muscles to greater play and the user is afforded a constant incentive to deeper breathing in attempting to push the indicator to higher figures. Its use is said to result in rapid improvement in breathing and chest development.

RAILWAY RUNS MOTOR TRUCKS FOR SHORT-HAUL FREIGHT

To handle short-distance packages of less than carload lots of freight, the Pennsylvania railroad has put on a fleet of motor trucks between Wilmington, Del., and Philadelphia. This is regarded as a significant decision, as for years privately owned trucks have made inroads into the freight tonnage of the older carriers, but now the way has been opened to make them the allies instead of the competitors of the railways, according to traffic experts. Increasing use of trucks also will affect the highways, which already are overcrowded. On the more used routes, it is said, special roads will be necessary for trucks exclusively. Connecticut, for instance, is now paralleling the Boston post road with a highway for freight traffic only, and it is expected that this example will be followed shortly in other sections of the country.

"TRICK" FURNITURE SAVES RENT AND SPACE IN APARTMENTS

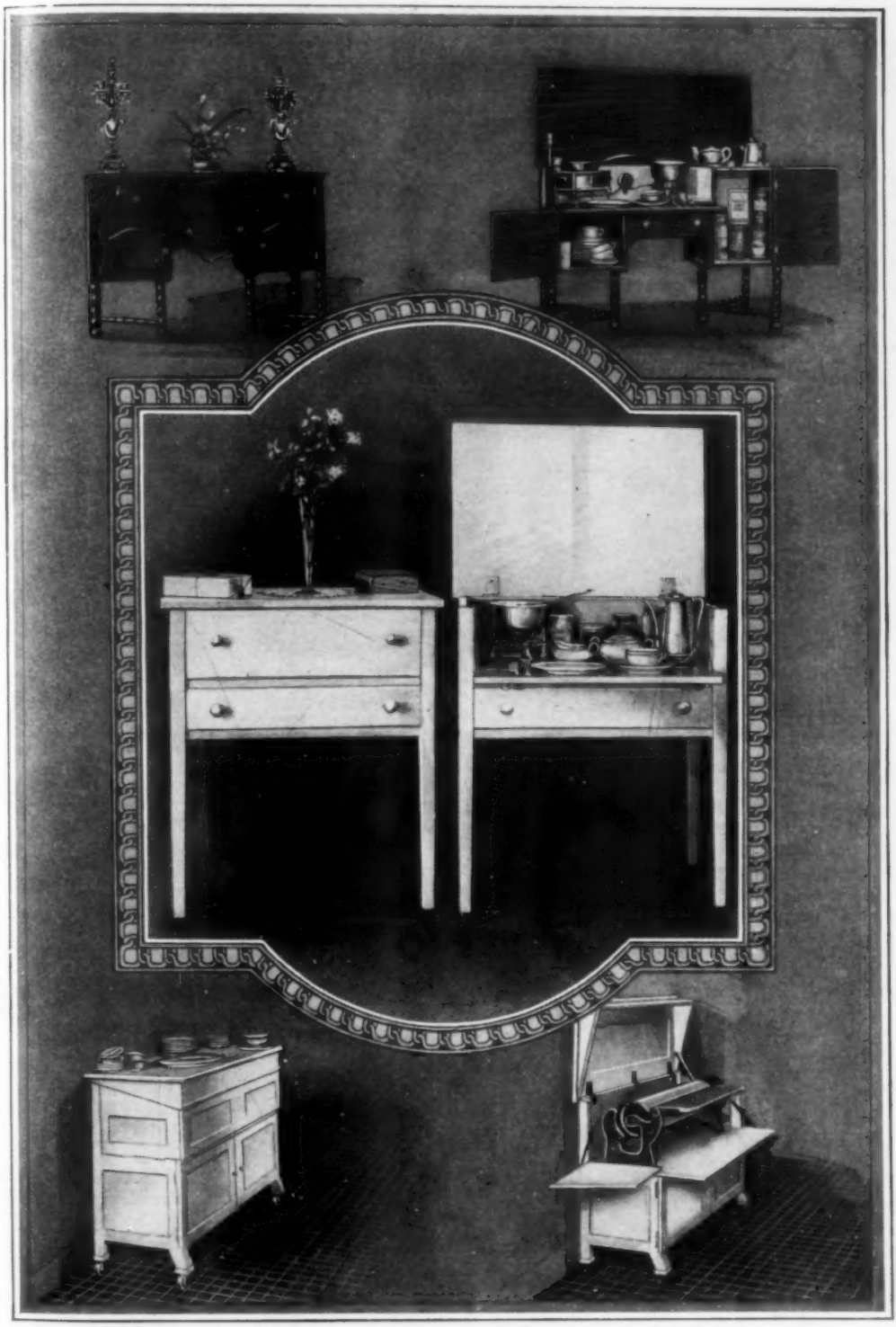
With the constantly increasing demand for economy of space because of the high rentals demanded for city apartments, the building of what is known as "trick" furniture has developed into an industry, and its design has challenged the ingenuity of inventors in all parts of the country. Beds that fit in doors, kitchenettes hidden in tables, ironers folded out of sight in attractive cabinets, radio outfits concealed in tea wagons, and many other useful devices have been constructed to save space with a consequent lowering of rents. Furnaces that are as decorative in appearance as a phonograph, and electric stoves that automatically shut off the current when the food is done, help to lighten the burdens of the modern housekeeper. As a result, three rooms may be made to meet the requirements which previously needed six.

OFFICE CLIP HAS FORKED KNIFE FOR OPENING ENVELOPES

For opening envelopes, an office clip is being made with a V-shaped notch in its end, both sides of which are sharpened to a cutting edge. After inserting either of the jaws under the flap of the envelope, the paper is kept against the knife while slitting by a slight forward pressure. New correspondence can be stacked in separate piles and fastened together by the same clasp used to open it.

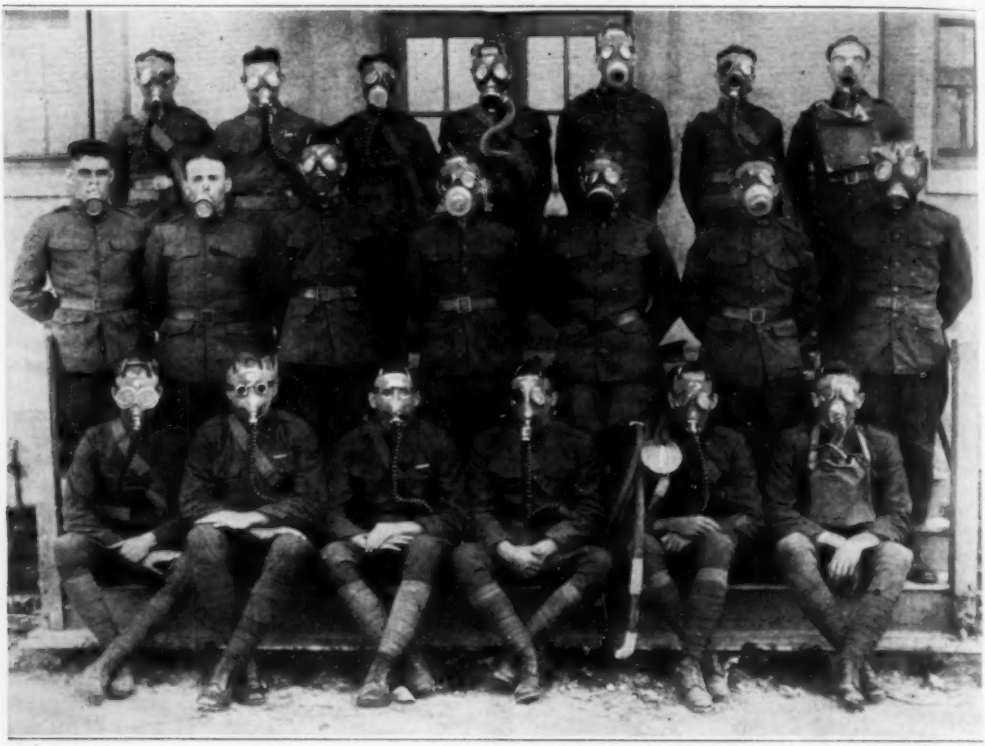
"HELLO" PASSING AS TELEPHONE GREETING TO SAVE TIME

After being in familiar use for years on the telephone, the conventional "hello" gradually is dying out in practice, according to an official of an eastern company. The reason for this is ascribed to economy of words and a desire to save time. The usual salutation now is, "Mr. So-and-So speaking." "Ahoy" was the word used by Alexander Graham Bell in his early experiments with the telephone, it is said, but this was discarded for the more easily pronounced "hello," which is believed to have originated in England when fox hunting was the favorite sport of the gentry.



Space-Saving Furniture Designed to Meet Demands for Economy of Space; How Kitchenette May Be Hidden in Table (Top and Center), and an Ironer in Cabinet (Bottom)

ARMY HAS GAS MASKS FOR ALMOST EVERY PURPOSE



Various Types of Gas Masks Developed by the Army to Combat Deadly Fumes and Adapted to Many Peace-Time Uses, Including Mine-Rescue Work and Fire Fighting

Gas masks to suit almost every need for such articles have been developed by the chemical warfare service of the army. Since the days of wet cloths used to combat the first waves of deadly fumes early in the war, protectors have been made with devices at the mouthpieces to enable wearers to talk into telephones. Special ones are designed for persons in submarines under the sea, while others have eyepieces which fit the ends of field glasses to guard those engaged in range work. Where fresh air can be had from another source, as in the case of workmen in oil or gas tanks, a mask with a long hose that can be run to the outside is provided.

PIPE CLEANED THROUGH SLOT IN BOWL WHILE ALIGHT

So that it can be cleaned thoroughly and easily while smoking and without removing the bit, a tobacco pipe with an opening at the base of the bowl through which obstructions can be removed, has been designed. The cleaner is inserted at the mouthpiece and is easily pushed the whole length of the stem and through the slot at the end, as the openings are in line. A sliding cover, fitting tightly over the opening, keeps it closed when the pipe is lighted. Breakage and wear on the stem are avoided with this design, as the bit does not have to be removed and the "cake" in the bowl is not disturbed.

Cleaner Inserted: It Passes Out through Lower Slot without Disturbing Tobacco in Bowl

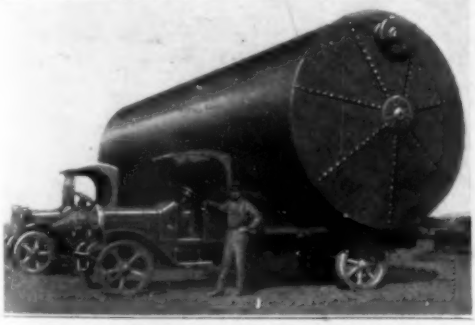
¶Catnip, which is highly relished by domestic felines, is also enjoyed by mountain lions and bobcats. Government hunters use oil from the plant as a lure in trapping the animals.

TREES PLANTED BY MACHINERY FASTER THAN BY HAND

Seedling trees can be set out by a machine used by the government forestry service, at a rate ten times as fast as hand planting. The planter digs the furrow, places the young twigs and feeds water and fertilizer to the roots. It then pushes the soil around the growth and packs it firmly. Two attendants are required to keep the supply of seedlings constantly in the hopper. As each row is put in an attachment marks the position for the next line. It is said that about 15,000 trees can be planted in a day by the device, which is drawn by two horses.

MOTOR TRUCKS, TWO ABREAST, CARRY EIGHT-TON TANK

To move a huge eight-ton oil tank three miles, a California company placed it on two motor trucks. The reservoir rested on loose blocks so that the vehicles could make turns in a space less than 100 feet wide. For loading the tank on the carriers, two other trucks were necessary. One dragged the immense cylinder along a platform by means of a cable looped around it, while the other car held the weight under control by keeping another rope attached to it stretched in the opposite direction.



Hauling Huge Tank on Team of Motor Trucks that Were Guided by Arm Signals

The drivers were guided in maintaining the proper distance apart by arm signals given by a man walking ahead, and by keeping a tight stretch on a wire that connected the front ends of the machines.

¶To promote the advance of aviation in the United States, a New York university has established courses in aeronautical engineering and industrial aviation. The plan has the financial support of the pioneers in the field of aviation.

STEEL CLOTHES CABINET BARS DUST AND PREVENTS MOTHS

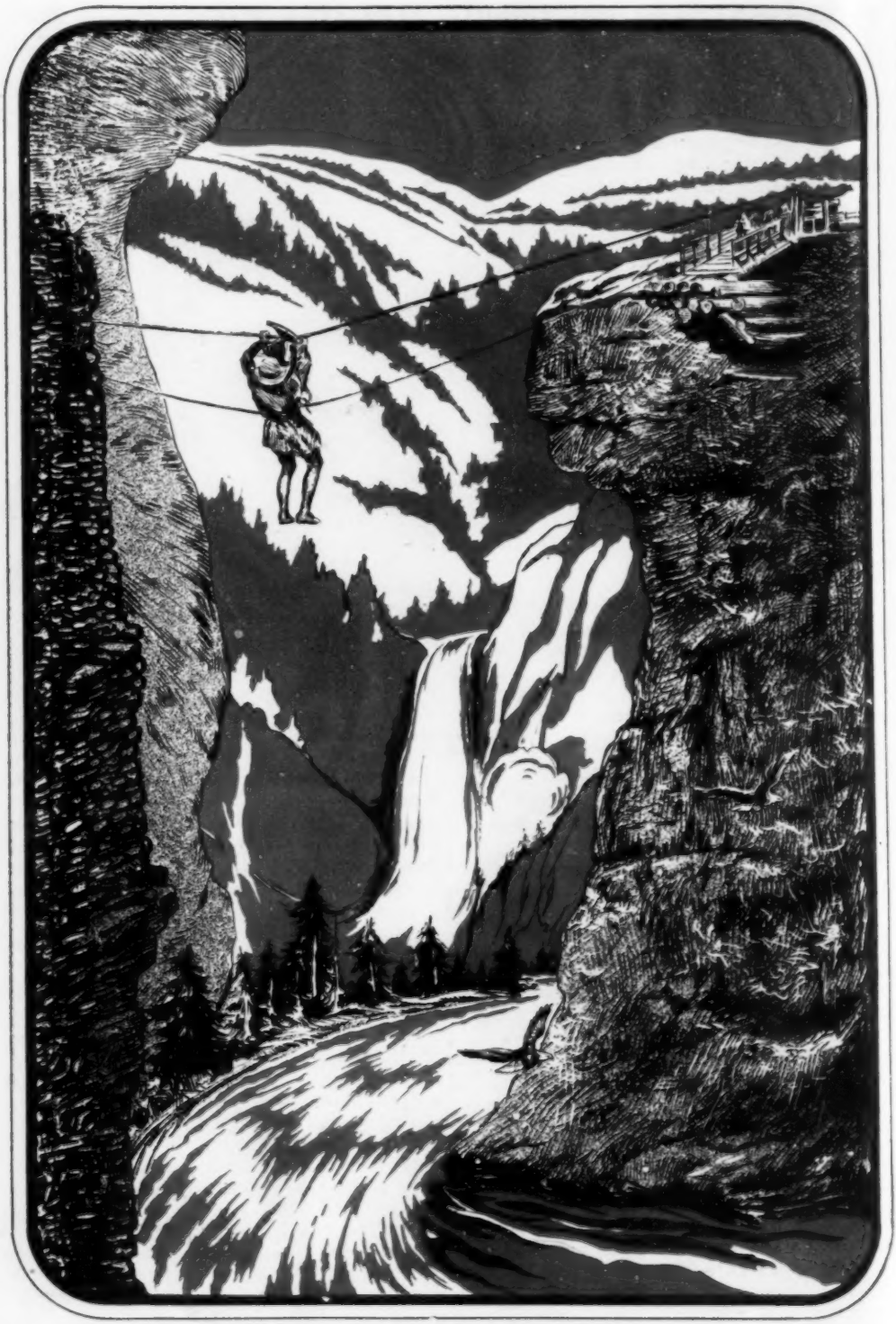
Moths are barred from the interior of a steel clothes cabinet that is airtight and of sturdy design to resist intruders. It is said

Metal Cabinet for Clothes and Furs that Is Airtight to Keep Out Moths and Dust

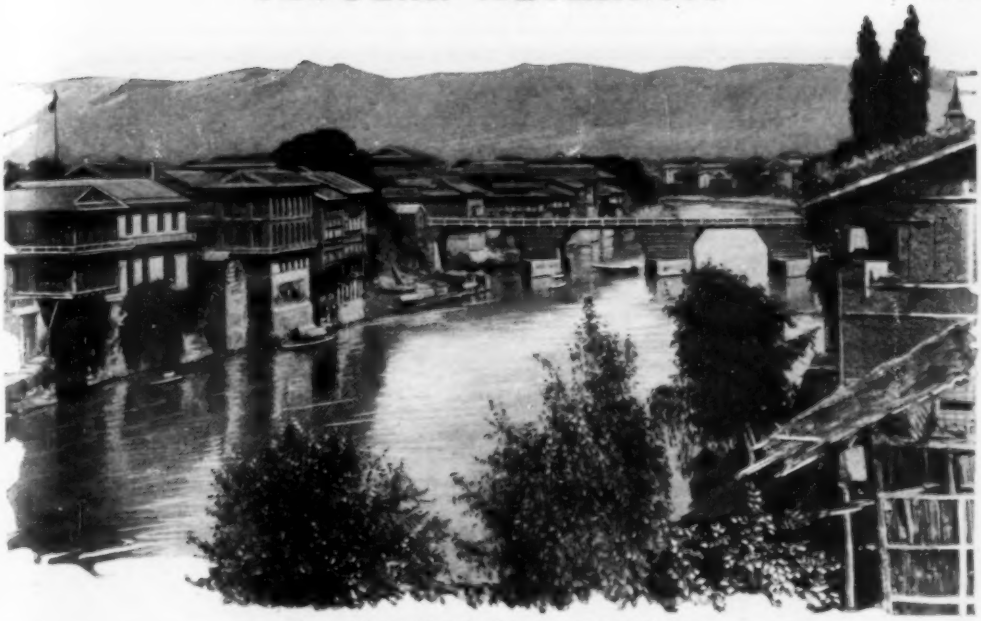
that eggs of the destructive insects can not hatch, if by chance they should be carried within, owing to its construction. Garments infested with the pests can be cleared of them by placing the apparel in the locker with a fumigating solution. Furs and clothing, it is claimed, remain unsoiled by dust, even after long periods of storage in the vault. Chemicals that destroy insect life can be permanently kept in the cabinet, increasing its effectiveness.

BLIND BUILD ELECTRIC-LIGHT SOCKETS AND CIRCUITS

Inmates of a Chicago training institution for blind persons assembled more than 35,000 electric-lighting outfits for Christmas trees during the past year, it is reported. Cutting and scraping the wire, soldering and fitting the sockets, and testing the finished sets comprised the tasks of the workers. The completed material is tried out on a special machine equipped with a buzzer that sounds to indicate the perfect article. A contract involving 500,000 sockets was previously completed by the sightless toilers. About $115,000 were earned in one year by ninety-eight graduates of the school's course and this total will be increased in the future, it is hoped.



Explorer Crossing Deep Chasm on Rope Bridge in Depths of Asia Where a Fall Meant Certain Death in the Torrent Rushing from the Mountains toward the Sea



One of the Bridges in Srinagar, British India

Bridging the Countless Chasms of Asia

Abysses Are Spanned with Steel, Stone, Chains, Ropes, Cables High Above Torrents that Have Endured for Ages

By SVEN ANDERS HEDIN

WHAT a hopeless task it is to attempt to describe in a few columns of a magazine the viaducts which, in the greatest continent of the earth, make it possible for individuals, caravans and railroads to cross rivers and abysses!

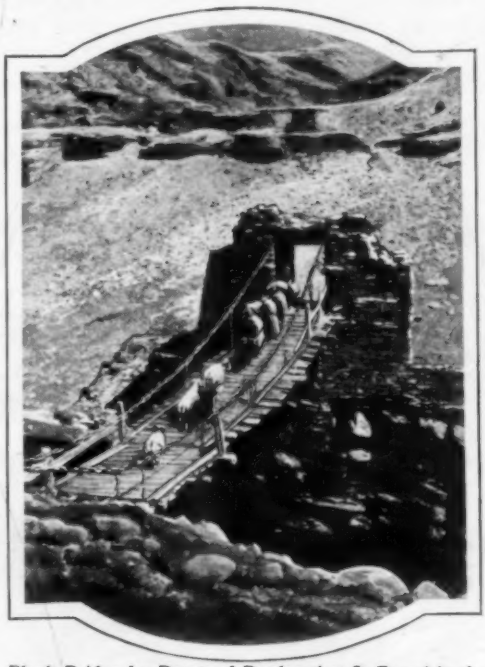
Nobody has ever attempted to count up the bridges of Asia, and nobody who would engage in such a hopeless task would ever succeed. From the imposing and substantial railroad bridges, which in their huge dimensions can emulate structures of their kind in Europe and America, down to the small, single ditch-planks, which in the Chinese and Mohammedan world are connecting one bank with another, we can number bridges by the hundred thousand over countless watercourses of varying size—some as immense as the Amur river, some as insignificant as the canals of the irrigation system of Turkestan.

As I am now trying to arrange my memories, there seems to pass before my eyes a motley pageant of bridges, some of them a thousand years old and more, others quite young, and others again swept away by the high flood of every summer, and then newly built every fall. I recall bridges of stone, of tile, of iron and cement, of chains, ropes and cables, of wood, posts, planks and branches, and the natural rocks which in the course of time have broken asunder from a mountain and tumbled down into some wild ravine, where they now serve as spans for the natives.

Sven Anders Hedin, noted authority on those little-known lands, Tibet, Turkestan, Mongolia, and central Asia in general, has spent a great part of his life—he is now 58 years of age—in exploring these strange lands. These journeys, performed at times amid extraordinary hardships and always at the immediate risk of lingering and terrible death at the hands of savages or by starvation, have won for him high honors and a world-wide reputation and fame. Doctor Hedin is an honorary or active member of nearly every scientific society in the world; is the bearer of honorary degrees from most of the famous universities of the civilized world, and is now on his way to Asia for another journey through the wild interior where he has found strange buried cities and grotesque and terrible customs.—Editor's Note.

Primitive Bridge of Twisted Rope Used by the Natives of India in Place of the Substantial Spans Known to Civilization; Some of These Are Hundreds of Years Old

And I imagine I hear the rattling of heavily laden railroad trains, which on singing structures of iron are speeding forth over the gigantic rivers of Siberia and India. I hear the tinkling of bells, while caravans of camels are plodding over playful whirling eddies; the measured echo of clattering hoofs, as the horsemen are scampering over the tottering planks of a treacherous wooden bridge; the cheering call of herdsmen, as they are driving out their sheep on rocking structures over winding brooks. My ears are humming with the deafening roar of the waters which were rushing by, underneath my feet, while I was standing again on so many bridges in the remote corners of Asia and in the boundless wilderness that fills so much of the heart of the continent. What masses of water are streaming underneath all these in the course of years, of decades, of centuries! They never run dry, getting new nourishment steadily from their sources in the mountain tracts, and they never become tired of thronging toward the sea.



Plank Bridge for Beasts of Burden that Is Found in the Chinese and Mohammedan World

Asia is like the roof of a house, irregular in shape, falling off gently in the various directions. From its crown, rain water is pouring down in all directions. Near Erzerum in Armenia, I visited a place where, within an hour's time, a man can ride to the sources of three rivers flowing to different seas. No matter where the watercourses arise, they are still, as they sweep onward, crossed here and there and again by paths; in fact, these crossing points are almost innumerable, and countless likewise are the bridges which lead over the bright and gentle waves of some of these rivers as well as over the dark and eddying ones of the others.

In what follows we can leave entirely out of consideration the large bridges in the "edges" of the continent. Railroad spans are built everywhere on the same principles, and their aspect changes only in form and dimensions. On that part of the Bagdad road which had been finished in 1916 when I traveled it, only one bridge of gigantic dimensions was to be noticed, namely, the one which leads over the Euphrates near Jerablus. This high iron structure, painted in red and resting on ballast beds, made a strange impression in the desolate Asiatic landscape with its lack of striking contrasts.

When Annenkoff's famous railroad was extended from Merv to Bokhara and Samarkand, the Russians, owing to their haste and to the expense, had to content themselves with a temporary wooden bridge over the Amu-daria near Charchui, an unprecedented structure as regards length, 4,592 feet, when considering the fact that it rested merely on posts driven down into the river bed.

Leaving now the subject of railroad bridges, and directing our attention to some larger rivers which are crossed by caravans, we naturally think first of Euphrates and Tigris. In 1916 I rode on a Turkish ferry down the first-named river and covered in this way more than six hundred miles. I had had built a cabin of boards, in which I was living. It was in the middle of April and I had a table and a chair, so I could draw a map of the stream, with the aid of a compass and watch, and note the velocity of the current. As our ferry reached Deres-Sor, where the caravans pass over the Euphrates and an island divides the river into a larger eastern and a smaller western arm, we took the course in the latter direction. A wooden bridge leads from the main land to the island. The river was high and the current violent, so we drove quickly downstream against the bridge. Our situation looked threatening, because the horizontal bridge beams were not sufficiently high over the level of the stream to permit the cabin to pass underneath.

Had we driven with the full speed of the current against the bridge, either the cabin

would have been shattered to pieces, or if its power of resistance had been strong enough, the ferry would have capsized, and been lost beneath the choppy waves. But luckily my ferrymen succeeded at the right moment in mooring the vessel just above the bridge, and there we had a carpenter saw off a foot from the height of the cabin so that we could pass under. The lost roof was then replaced by a canvas cover.

Near Mosul, directly opposite the ruins of Nineveh, an angular bridge of ludicrous appearance spans the Tigris. Half of it consists of stone and tile firmly imbedded in the ground, while the other half is upheld by pontoons. From the balconies of the Mosul cafes, which are in a long line skirting the right shore of the Tigris, and where the Turks and Arabs with their nargilehs or waterpipes are enjoying their "keif," that is to say, their truly Oriental idleness, a superb view can be had over the famous river and over the bridge with its lively traffic of camel and donkey caravans, horsemen, pedestrians and carts.

Crude Boats Made of Skins Help in Crossing Unbridged Streams Often Found in Asia

In Bagdad, the classical city of the Arabian Nights Tales, and one time the capital of the Abbaside caliphs, the two banks of the Tigris are connected by a pontoon bridge of this time-honored system. The pontoons are anchored at the bottom of the river, as well as it possibly can be done, and over them beams are laid to carry the cross planks. When I passed over this bridge for the first time, in 1886, I found it just as much worn out as when I traveled over it thirty years later. But probably its gray, shaggy and corroded paint had been renewed more than once in the meantime.

The Bagdad bridge, however, is inadequate for all the traffic between the two parts of Harun-al-Rashid's city. If the populace on the outskirts of Bagdad want to pass over to the other side, they do not choose the circuitous route over the bridge, but resort to their quaint, round, basket-shaped boats, the guffa, or else they swim across, on top of two air-filled goatskins.

From the ferry on the Euphrates I once noticed a man who came walking down to the shore of one of the wide water-arms of the stream. Without stopping for a moment, he took from his back an empty goatskin and blew into it with all the force of his lungs, so as to fill it with air, and twisted a cord around the opening. Stripping himself naked he rolled up his clothes, fastened the bundle on his head and threw himself into the river until the water was reaching up to his armpits and he had to make use of the goatskin, so as to reach the other side in swimming. When he arrived he let the air escape from the skin, dressed and continued his walk as if nothing had happened. He had thus made his way satisfactorily without any bridge.

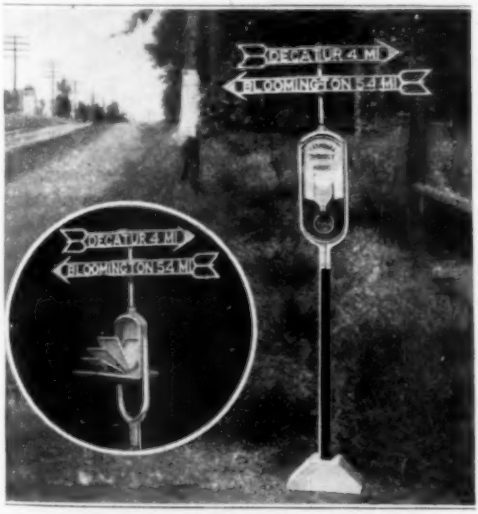
In a similar, although more complicated, manner, the Tajik and Kirghiz natives are used to making their way across the waters of the Raskan-daria, one of the mighty sources of the Yarkand-daria in southern Pamir. With their help I once made my way over the river near Tong. Every once in a while merchants arrive there with horse caravans. The animals swim across, while the men take places on a small float whose under-rafters are borne up by air-filled goatskins.

UNIVERSAL LANGUAGE OF COLOR HAS NOTES LIKE MUSIC

Color notes, by means of which others can produce tone harmonies they have never seen, have been devised by a noted chemist. It is predicted that this system will do away with the present elaborate outfits of color samples and substitute an exact and universal color language, by means of which contracts and orders can be executed without previous inspection of the goods. It is expected to be particularly valuable in the clothing and house furnishing industries.

TOURIST GUIDE ON SIGN POST GIVES WAYSIDE DIRECTION

Information to aid the tourist is supplied at the roadside in a convenient waterproof, box arrangement, attached to a metal guide designed by an Illinois inventor. Cards printed with highway maps, facts about cities and towns and other helps to the traveler are fitted into frames on pivots in a case with a door, which automatically closes when the tourist has finished his examination of the leaves. When the box is opened, the cards are tilted forward to a comfortable angle. A bar weight swings back and closes the frames when pressure is released and protects them from exposure.



Roadside "Information Bureau" in Sign Post: Inset Illustrates how Leaves Open for Inspection

Ducks are fond of honey bees and are able to swallow them without being stung.

DISK IN RAIL-COACH WINDOW HELPS TO VENTILATE CARS

Passengers are spared the annoyance of tugging at car windows to open them, and discomforts caused by drafts are avoided by an easily regulated ventilator which fits into the lower part of the outside pane. It is a perforated metal disk with a sliding cover attached over a circular hole cut in the glass. When the lid is turned, an opening lets in a current of fresh air. Less dust and dirt gain access in this way than when the window is raised. The size of the opening may be increased or diminished to suit the wishes of the passenger. The disk does not obstruct the view, as it is placed low on the pane and occupies but little space.

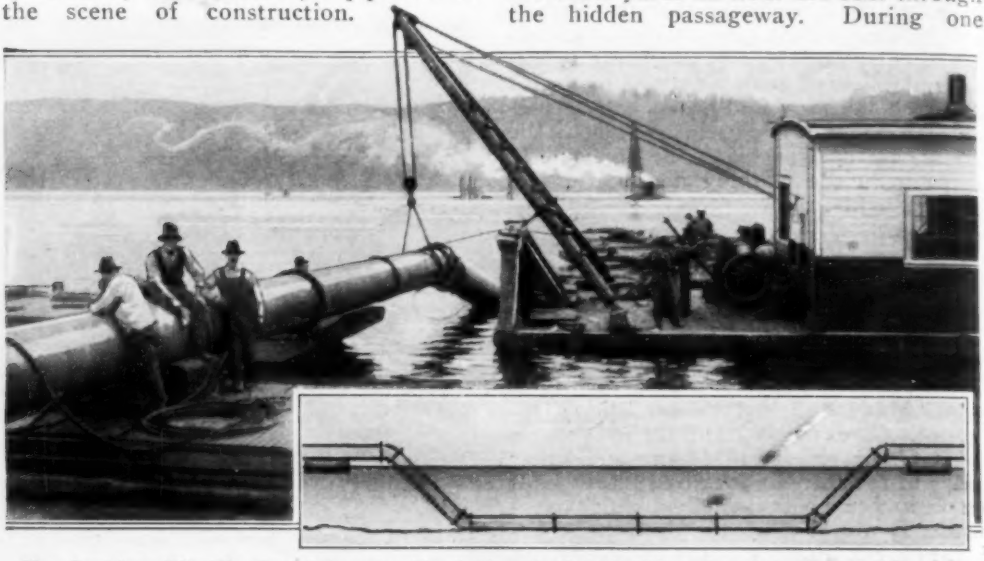
Rotating Ventilator Disk and Position It Occupies when Fitted into Window Pane

DIRECT CABLE LINKS EUROPE WITH INLAND CITIES OF U. S.

Through the development of a repeater that automatically transmits signals from ocean telegraph cables to land wires, Chicago has been directly linked with the cities of Europe. Heretofore, all matter for points within the United States has been taken off the submarine wire and relayed from the coastal terminal points. With the new method, the time required for a message to make its way from a foreign station to destinations remote from the seaboard will be greatly reduced, it is said. An apparatus with a needlelike pen controlled from the sending office has been installed in Chicago. The device prints a code of dots and dashes on a running band of paper from which they are translated for delivery.

SAND IS FORCED THROUGH PIPE ON BED OF RIVER

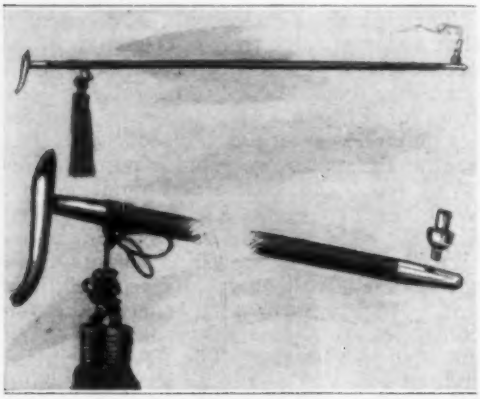
Sand for a dike being built on the Columbia River, in Washington, is drawn from the opposite side of the stream almost a mile away and carried by a pipe line to the scene of construction. About a half mile of the tube rests on the river bottom in order to avoid interference with shipping passing through the channel. Pumps mounted on a giant dredge force the material to its destination, as it is lifted by chain buckets. An average of 900 cubic yards an hour are sent through the hidden passageway. During one month, almost a million yards of sand were shot beneath the river to become part of the huge barrier, to be twelve miles long.



How Sand for a Dike Was Forced through a Pipe Laid on the Bed of a River, Out of the Way of Ships, from a Pit Almost a Mile from Scene of Construction

CANE AS CIGARETTE HOLDER AIDS MAH-JONGG PLAYERS

Resembling a walking stick, a cigarette holder for use by players of Mah Jongg is being made with the socket at the bottom and the mouthpiece in the head. It is said to be of great convenience to those participating in the game, because it permits smoking without the annoyance of having constantly to lay the "smoke" aside while manipulating the pieces. It also keeps the raw fumes of the tobacco from the eyes. Ornamented with a brilliant tassel, it is strongly made, and the metal mountings are highly polished. The length of the "cane" is claimed to give an added coolness to the smoke.



Decorative Cane that Serves as a Cigarette Holder for the Players of Mah Jongg

RABBITS ARE SLAIN BY PLAGUE AT SEVEN-YEAR PERIODS

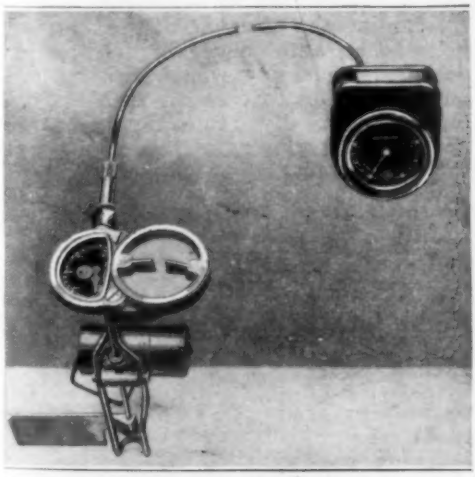
Recurring every seven years, a disease which is fatal to wild rabbits depletes their numbers by thousands, according to scientists. Cottontails, northern hares and the "jack rabbit" common to the sagebrush plains of the west are said to be afflicted with the malady. When their numbers become scarce, coyotes, foxes, wolves and other animals that prey upon them are forced to seek better hunting grounds, and start to make ravages on the grouse and other game birds.

TYING CAST IRON INTO KNOTS MADE EASY BY HEATING

Transforming cast iron into a metal that virtually can be tied into knots is said to be the accomplishment of an eastern inventor. Everyone is familiar with the brittleness of most iron castings. Many are so hard that they are difficult to machine. By a special process of heating the metal, it has been found possible to render it pliable, easy to bend and almost springy. Previous attempts along this line are said to have weakened the castings, but the latest method is declared to add to their strength. The iron is raised to a temperature of about 1,600 degrees Fahrenheit, while protected in a muffle surrounded by a gas flame and open at the top. The conversion is accomplished in a little less than an hour.

PADDLE ON GAS-GAUGE FLOAT WORKS DIAL IN AUTO

Equipped with a paddle fixed to a float, an automobile gasoline-tank gauge operates a dial on the instrument board when the car is in motion. As the liquid shifts about under the swinging of the machine, the rudderlike attachment is washed back and forth, causing the register hand to move smoothly on the scale. Even when the reservoir is being filled, the device is sufficiently affected by the ripples within to show the growing quantity on the dial. The arrangement is said to eliminate necessity for the driver to dismount to inspect his fuel supply. It is also claimed that the paddle insures a more accurate record than ordinary types of indicators.



Dial for Auto Instrument Board and Float to Tell Exact Amount of "Gas" in the Tank

GALOSHES FASTENED WITH KEY THAT LOCKS ROWS OF TEETH

Galoshes are being made to fasten with two rows of metal teeth that lock together as a "key" is pulled across them. It is

Fastening Galoshes with a Pull on Key that Locks Row of Teeth

claimed that this method permits the overshoe to be adjusted in a few seconds and leaves a smooth surface with no buttons or buckles. When the footgear is to be removed, a downward stroke of the fastener separates the two edges. Closing tighter than the ordinary galoshes, cold and moisture are said to have little chance to penetrate to the inside. The key is concealed under the folding top of the boot.

WOODEN-TOY INDUSTRY GROWS UNDER TRAFFIC EMBARGO

European competition having been almost killed by the traffic now in force, the wooden-toy industry is booming in America, several large centers of manufacture having sprung up. These factories are declared to be excellent outlets for the by-products of many working mills and go a long way toward making the lumber and coarse products" plants profitable. The largest center in the east is at Winchendon, Mass. Owing to the growing scarcity of wood and the cost of labor, wooden toys have increased in price in the last ten years about 100 per cent. Reforestation and scientific forest management, it is said, will tend to reduce current costs.

BEARD IS REMOVED WITH MUD AND USE OF X-RAYS

Shaving beards from men's faces has been accomplished by a special mudlike paste that is undergoing experiments at

Man's Beard Being Removed with Mud (Bottom) and X-Ray Used for Facial Treatment

the hands of a New York doctor. After the mass has been applied, it hardens and is torn off. To finish the operation, X-rays are then directed against the skin. The originator of the method claims that it is beneficial and if used regularly will remove scars and similar marks of long standing. It is also said that the sticky treatment does not leave any ill effects on tender skins.

READY-MIXED CONCRETE STOPS BLOCKING OF STREETS

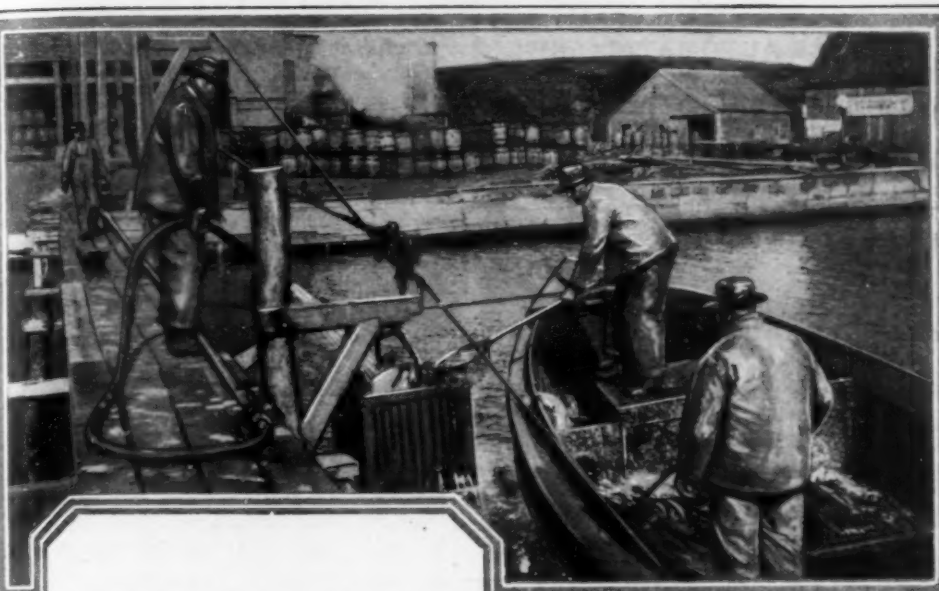
Concrete has become so widely used that a company in one city has found it profitable to supply large and small amounts of it in ready-mixed batches for the needs of individual consumers. Orders are taken by telephone, or by estimators who survey the "job," and the material is rushed to the buyer in motor-hauled tubs and dumped where it is needed. This saves the buyer the labor of mixing it himself and from having unsightly piles of sand, gravel and other material on his premises. Extensive contracts for street paving and other work have been undertaken in this way, and the plan is said to have been successful, especially in preventing the obstruction of the thoroughfares with large supplies of materials. At the mixer, skilled workmen see to it that the exact proportions of each ingredient are used. The motor haulers cover a wide radius in a short time.

RED DYE MIXED IN GASOLINE TO PREVENT ACCIDENTS

Colored cans, plainly marked, have been used widely to hold gasoline so that disastrous mistakes might be avoided. Now it is proposed to color the gasoline itself with a brilliant red dye so that it can be distinguished instantly from water or kerosene. The suggestion is made by the bureau of mines as a further safeguard against accidents. Tests have shown that the dye found suitable for the purpose does not injure motors nor lower the fuel value of the gasoline. Enough of it to color 1,000 gallons can be purchased for seven cents and it mixes quickly as soon as it is poured in. During the war, army and navy regulations required that all gasoline of "fighting grade" be colored red to distinguish it from ordinary motor fuel. The plan proved successful in preventing mistakes.

STEERING WHEEL LIKE SHIP'S IS HELP TO MOTORISTS

Adapting the principle of the mariner's helm to an automobile, an inventor has designed a steering wheel with six projecting handles to ease the task of guiding the car. By removing the strain necessary in gripping the wooden rim in the usual way and providing means for powerful leverage to aid in holding the car in mud or on slippery pavements, the handles enable the driver to lean comfortably back against the cushions, even on hilly or sandy roads. The wheel is made of polished aluminum and is eleven and one-half inches in diameter. The handles are brass tipped and are each four and one-fourth inches long. They do not interfere with the driver in the operation of other parts and enhance the appearance of the car.

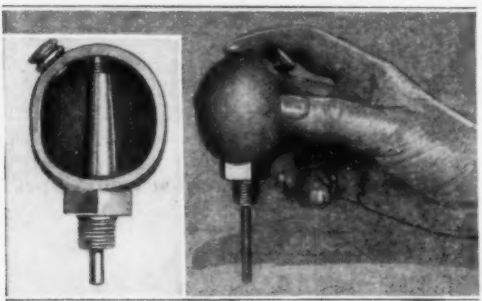


FISH ARE KEPT FRESH A YEAR IN MAN-MADE ZERO CLIMATE

Fish caught off the New England coasts are kept fresh for more than a year by being stored in "freezer" houses where temperatures of between 12 and 16 degrees below zero are maintained. After the catch has been washed, it is packed in pans of water that are then placed on shelves. The air in the storeroom is artificially chilled until the fish become imbedded in solid ice. The slabs are removed from the trays and stacked in tiers, much like cordwood. When needed for shipment, the ice cakes are broken up and the fish sorted in sizes before refreezing for transportation to distant points.

SAFETY PULLEY OILER ADJUSTS ITSELF AUTOMATICALLY

Waste and danger in oiling pulleys and clutches while running, are largely elimi-



Interior and Exterior of Pulley Oiler, Illustrating Brass Feed Pipe and Spring Control

nated through the use of an automatic oiler permanently attached to furnish continuous lubrication while the parts are in motion. It consists of a metal ball in which the oil is held, and has a brass pin at the bottom to feed the lubricant upon the shafts and inside the bearings. The pin rests against a spring inside the ball, and when the pulleys move compression is caused and releases oil. The device is constructed on the vacuum principle and retains the lubricant when the shafts stop. It may be regulated to suit the speed of the pulley, prevents accidents and wear on the machinery by insuring proper lubrication of the parts, and decreases the likelihood of fires frequently caused by friction or drippings from improperly oiled bearings.

¶In 1922 there were more patent applications per 1,000 inhabitants filed from Connecticut than from any other state in the union, or any other country in the world.

SLIDING CHEST BENEATH BED SAVES STORAGE SPACE

Storage space for clothing, bedding and other articles is provided in a moth and dustproof chest fitted on brackets attached to the sides of the bed frame and made to slide on roller bearings, so that it does not take up extra room and is concealed from view. The bracket rails are furnished in various lengths to fit any size bed, and are clamped to the frame without the aid of tools. The lid of the chest overlaps, making it dustproof and when pulled out an attachment on the rails prevents it from tipping downward. It is high enough above the floor so that a duster may be run underneath it, and slides so easily that it can be kicked back into place.

Putting Extra Blankets in Handy Sliding Drawer that Makes Storeroom of the Space Underneath Bed: Chest Is Entirely Concealed when Pushed Back on Sliding Rail

Pitfalls to be Shunned by Inventors

Lack of Knowledge of Elemental Laws and of Other Efforts Along Same Lines Results in Wasted Time and Money

SIR John Dewrance, President of the Institution of Mechanical Engineers, London, recently declared that "more brain power is wasted by inventors than by any other class of people." He also said that "only one out of every 10,000 mechanical patents is worth doing anything with."

Since there are thousands of inventors in the United States who are devoting money and time to developing ideas, a survey of the situation was made in America which disclosed that the greatest waste of time is due to reinventions of things that have already been patented, tried out and discarded. For instance, a press was brought out recently to print large letters such as are used in window signs. It printed one letter at a time and used several colors. The work was excellent, but the inventor and promoter did not know that a somewhat similar machine had been tried out some fifteen years ago. The promoters at that time lost $50,000 in the venture, for it is practically impossible to design a printing press using large letters that will work by hand and give enough service to be commercially useful on a large scale.

Just a few years ago there was an epidemic of car-coupler inventions. It would be a waste of brain power to work along this line now because the field has been thoroughly covered, say promoters. The rotary engine also has been a pitfall for numberless workers, although it is nearly always possible for a persistent man to produce a workable device from an original nonworkable one, experienced engineers say. Many such motors have been produced which will run, but which are not commercially practical. One promoter spent $4,500 on an engine and was preparing to make another "that would work." When he was asked why he had not consulted a mechanical engineer, he replied that "the machinist who built it knew all about engines." When asked if he was going to consult an engineering expert before he tried again, he replied that he was not, because he knew why the first one would not work and he could now go ahead and manufacture the engines on a large scale. Two years were wasted by a mechanical draftsman in developing a card-shuffling machine. Recalling his experience, he said: "The device worked perfectly. Repeated experiments disclosed that it never shuffled the same way twice. All the cards were thoroughly mixed and cheating was impossible. But when we tried to sell it we lost out. Gambling houses would not buy it because their patrons could shuffle the cards faster and with less trouble than the machine could. People who could not shuffle cards could not afford to buy the machine, which sold for $250. I made a trip through the west and sold five machines. That is all the money anyone ever made out of it."

Many inventors waste brain power, it is said, in bringing forth worthless devices

Inventive Genius of the Nation Guarded by Patent Office

THAT the value of inventive genius received early recognition in the United States is proved by the following excerpts from a circular issued in 1811 by Dr. William Thornton, first head of the patent office:

"Viewing with astonishment the inventions of my countrymen, I cannot contemplate them without being impressed with the idea that no nation on earth surpasses them in genius.

"The issuing of patents is grounded, not only on a desire to promote the progress of useful arts, but also to prevent loss of valuable secrets; for many have been buried with the inventors, previous to the organization of this system of protection.

"As it can be mathematically demonstrated that no human invention can produce a machine capable of undiminished power, or power regenerating itself, and forming what is called a perpetual motion—an operative model will be demanded for every such attempt."

because they do not know some of the simple laws of physics. An invention of this sort was a water propeller which revolved at high speed and got its propulsive reaction from imparting great velocity to a small quantity of water. This, however, constituted a greater waste than the ordinary loss with the present type of propeller. Had the inventor consulted a marine engineer familiar with the laws of hydromechanics he would have been saved a great deal of loss in time and money.

Some years ago a quarter of a million dollars were said to have been spent in perfecting a compressed-air starter for automobiles. All this money was lost because the promoters could not find a valve that would hold the compressed air without loss for any great length of time. A man having this starter on his car would drive into the garage at night and find in the morning or a day or so later that all the air had leaked out of his compression chamber. This device violated the practical law of inventions that a successful invention must stand up under ordinary usage for a reasonable length of time.

Inventors waste most brain power, according to practical experts, in "solving" problems in mechanics, engineering, chemistry, physics and other fields of applied science, which already are well known, or in trying to do things that, by the simplest laws of mechanics, are utterly impossible. Unfortunately they do not know that this information generally is easily obtainable and freely given by people who have it. Inventors have great fear that in asking for information, they will reveal their idea and thus lose it by theft. He is a lucky inventor whose invention is good enough to be stolen, is an old saying.

"DEATH METER" URGES DRIVERS TO MAKE STREETS SAFE

As part of a safety campaign, a "speedometer," fifteen feet in diameter, on which were recorded the automobile fatalities for the day, week and year, was erected in plain view of motorists on one of the busiest streets of Buffalo, N. Y. The figures and slogans, urging drivers to greater care, were visible for blocks, and the form of the warning sign vividly impressed the need for a decrease in reckless driving and for greater community pride and co-operation.

Impressive Street Sign That Urges Safety by Recording Auto Fatalities and Accidents Daily

SPARK LIGHTER ON GAS BURNER AVOIDS DANGER OF MATCHES

Inconvenience and danger in lighting gas heaters with matches are eliminated in a sparker fitted at the top of the burner. By turning a projecting key, a spring trigger arrangement shoots a large, hot spark into the ascending fumes of gas and ignition is quickly accomplished. The lighter does not mar the appearance of the heater, can be attached quickly and does not get out of order easily or misfire when turned.

¶ More than twenty billion telephone conversations were held in the United States in 1922, according to recent figures.

LURE OF GLITTERING JEWELS COSTS MORE EVERY YEAR

In the course of the last fifty-five years, it is estimated, the people of the United States have spent substantially one billion dollars for diamonds. Statistics show that between 1867 and 1917, diamonds and other precious stones to the value of $771,544,558 were imported, and of this total, $750,000,000 represented the value of diamonds alone. When finally cut, set and disposed of to the ultimate consumer, these gems were worth at least twice their import value. In the five years following 1917, our imports of diamonds amounted to $200,000,000, and in 1922 the imports totaled $67,000,000.

CLAMP FOR IDLE AUTO WHEEL KEEPS WEIGHT OFF TIRE

To keep the weight off the tires of automobiles standing idle for long periods, clamps have recently been invented by a New York man to replace the ordinary jacks. The appliance is equipped with strong jaws that work on springs and clutch the edge of the rim, supporting the car from a base on the ground. After they have been placed on the wheel just above the point where the tread touches the floor, the machine is moved so that they pass under the tire and raise

Clamps for Lifting Weight of Automobiles Off Tires When Cars Are Being Stored for Long Periods

the automobile. Strongly made, the holders can be attached or removed in a few minutes and their cost is but a fraction of that of larger types.

The Popular Mechanics' Bureau of Information offers its free service to all readers of our magazine. Names and addresses of manufacturers and dealers in articles described, and any other details in our possession, will be promptly furnished by addressing the Bureau.

HOSPITAL IN SIDEWALK BOOTH AIDS VICTIMS OF TRAFFIC

To care for victims of traffic accidents, a booth containing first-aid equipment, a

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Sidewalk Hospital for Victims of Traffic Accidents, Placed Near One of Berlin's Busiest "Corners"

folding hospital bed and a wheel chair, has been placed near one of the busiest spots in Berlin, Germany. In case of injury or sickness, the patient can receive preliminary treatment before going to a hospital. The instruments and material are easily reached and can be set up in a few minutes. Strongly built, the booth is inclosed by doors, and is decorated in large painted inscriptions announcing its purpose and giving instructions for the use of the contents in emergency cases.

TUNNEL CREW IS FED BY DINER IN UNDERGROUND SHAFT

To save time and tiresome journeys for workmen engaged in tunnel construction in California, midday meals are provided on dining-car trains which rush hot food to the diggers far below the earth's surface. Each train is made up of five cars, three equipped with tables and benches and the others for serving and storing the food. Containers like fireless cookers keep the dishes hot on the journey, waiters accompany each train and an extra locomotive is attached to speed the service.

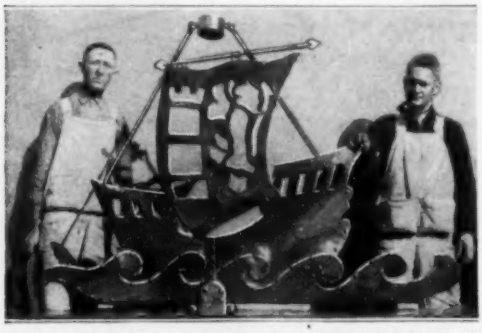
INDOOR GOLF "GREEN" RETURNS BALL AFTER PUTT

To aid golf players to attain accuracy in putting, an indoor "green" that directs the pellet back to the starting point has been invented by a western man. The toy can also be used as a pastime for any number of persons, and may be set up on a lawn or other flat, smooth surface. When the sphere is struck it passes up an inclined plane, and if it does not drop through the score hole, rolls back to the player. A channel at the side catches the ball, if it falls into the opening, and guides it out.

Practicing Putting on Indoor Golf "Green" with Regulation Sticks and Balls; the Sphere Is Returned Automatically to the Player after Every Stroke

GOLD-PLATED GALLEON'S SAILS SHOW WIND'S DIRECTION

Gold-plated metal sheets were riveted together, cut to resemble the outlines of a Spanish galleon, and swung inside a steel frame as a weather vane for the top of the tower of the California building in San Diego. The completed figure weighed more than 500 pounds, and was put in place by two steeplejacks who risked their lives on a scaffold erected for the purpose. An earthquake shock added to the hazards of the task while the men were at work.



Gold-Plated Galleon Weather Vane Mounted in Steel-Frame Support, and Its Designers

BIRD SONGS LIKE HUMAN TALK ACCORDING TO NATURALIST

Study of the sounds made by birds is urged by a scientist who declares their utterances resemble human talk. He said that these songs or one-syllabled calls, have inflections of pitch and emphasis closely resembling the same phenomena in the speaking voice and that at times the whistles, chirps or twitters, resemble human words. The building up of a dictionary of bird sounds with reference to their pitch, intensity, speed, form, expression and timbre was urged.

ENLARGING COLORING
A child can take a picture
But it takes an expert to finish it
A good picture is worth a million words.
ENLARGEMENTS LIKE THIS SIZE 50¢
You can color it
FILMS CAN BE DEVELOPED BUT ONCE
We do it right
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Display Supplied Four Times a Year for Dealer's Windows

Turning Out Photographs by the Million

Great Plants in All Parts of the Country Are Developed to Supply Quick Service and Assistance for Army of Amateurs

DEVOTED exclusively to developing films and printing pictures for an army of amateur camera enthusiasts, great plants have been built up in all parts of the country. During the "busy" months of June, July, August and September, when the weather is best suited to taking pictures, the seven largest finishing plants in Chicago handle more than 114,000 pictures daily. Several have an output of 8,000 to 12,000 every twenty-four hours, and many print more than 5,000,000 as an annual average.

In Cincinnati, a single company serves almost a hundred drug stores, employing a fleet of automobiles to collect the film and deliver the pictures to the proprietors who have found that the "side line" in film service is a profitable advertisement and brings in potential customers. In one week, one of the collectors for this company brought in 20,000 spools of film and as many as 17,500 prints have been distributed in a single day.

However, the volume of the business is not the story of the photo-finishing trade. The marvel lies in its high standard of efficiency, its speed and accuracy. Keeping thousands of orders from getting mixed up, maintaining a 24-hour or even shorter service, developing satisfactorily the work of untold thousands of untrained enthusiasts, including a few "cranks" who often know little of photography but are eager to get good pictures and extremely critical of the results, and how the larger companies with all the rush and confusion, find it possible to guide the struggling amateur with helpful suggestions from their experts hidden in vast dark rooms—all this represents a unique achievement in organization and service.

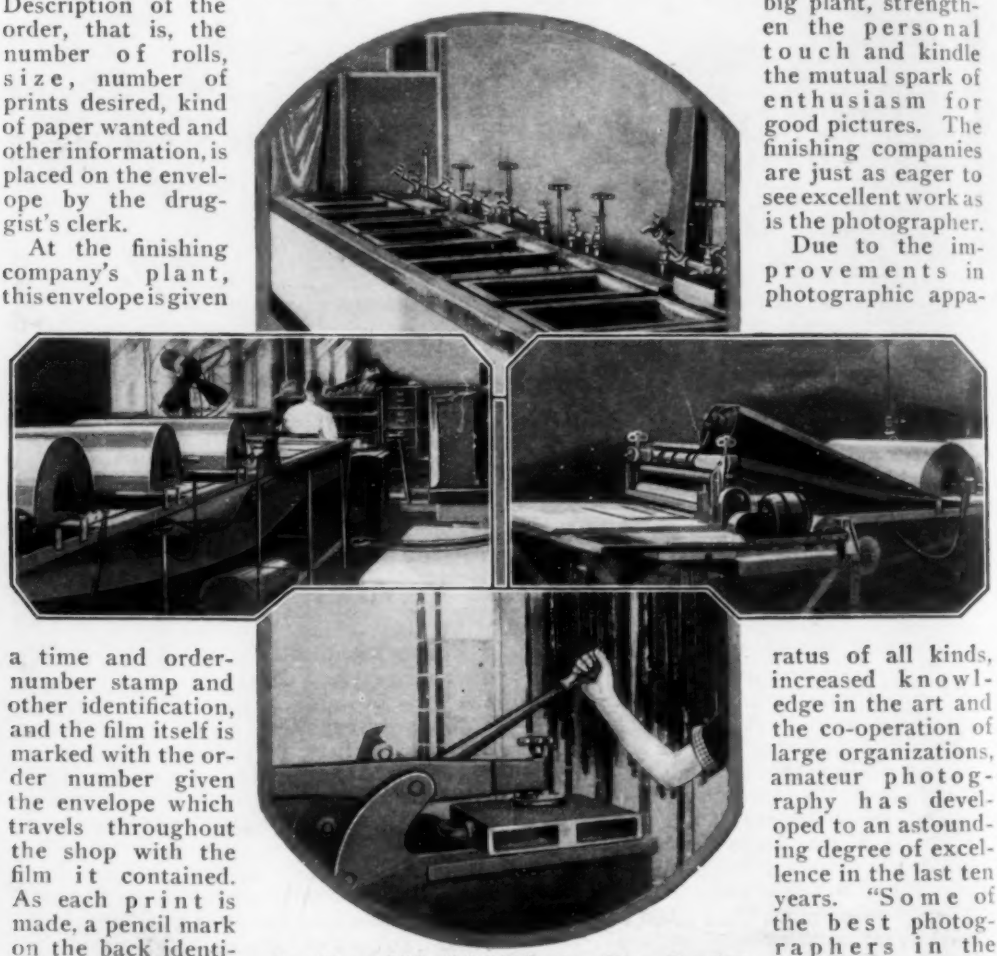
One company, for instance, printed over 500,000 pictures with just four errors, that is, wrong pictures or incomplete order. Co-operation on the part of all employes and an efficient system of checking as the films and prints pass through the thirty separate stages in the developing and handling processes made this record possible. A 24-hour service is maintained, but if rush work is wanted, it can be completed in less than three hours and give the delivery boy time to smoke a cigarette between the store and the shop, but this, the workers say, is not photography and the longer service insures the best results.

From the time the film leaves the cus-

tomer's hand at the drug store or other place of delivery, until it is developed, the pictures printed and returned for the customer, it is guarded with hawk-like vigilance, at least seven checks being imposed for possible errors and a rigid system, tried and tested, followed to minimize errors.

Description of the order, that is, the number of rolls, size, number of prints desired, kind of paper wanted and other information, is placed on the envelope by the druggist's clerk.

At the finishing company's plant, this envelope is given a time and order-number stamp and other identification, and the film itself is marked with the order number given the envelope which travels throughout the shop with the film it contained. As each print is made, a pencil mark on the back identifies it with the roll to which it belongs. Marginal marks are put on to assist in trimming the prints in lots of 200 or more. Rolls and prints are handled in "batches."



Four Views of "Daylight" Laboratory Where Negatives Are Developed, Printed, Finished and Sorted

At the sorters' tables, at the printers' lamps and at the dopers' tanks where the prints are developed, and at every step in the process, the batches are kept separate. If errors do occur, they are quickly located within these small lots and no work is allowed to leave the inspector's desk until every envelope again contains the film, cut, developed and printed, according to the specifications it bears.

Some companies amplify the service with helpful suggestions tabulated on the envelope opposite numbers for each print. The anxious amateur will find tucked in with the prints, "No. X would make a fine enlargement." "Your camera leaks light." "Try a sharper focus." These pointers, and others coming from the recesses of the big plant, strengthen the personal touch and kindle the mutual spark of enthusiasm for good pictures. The finishing companies are just as eager to see excellent work as is the photographer.

Due to the improvements in photographic apparatus of all kinds, increased knowledge in the art and the co-operation of large organizations, amateur photography has developed to an astounding degree of excellence in the last ten years. "Some of the best photographers in the United States are the amateurs," says H. C. Corning, vice-president of the Norman-Willets Photo Supply Company, of Chicago. "Nowadays, less than two per cent of their work goes back as N. G.'s—the blank film or that which cannot be printed. Only ten years ago, at least twenty per cent was no good.

"Here is an illustration. Last summer, a party of eight girls returned from the Yellowstone National Park with 120 exposures. They had 111 good pictures out of that number and not one of the girls had taken pictures before to any extent. Three years ago, I remember a girl came

Wrapping Finished Prints for Delivery to Customers

in with a bunch of forty-eight exposures and she had just one good picture of the lot. She had been working the time indicator instead of the shutter release. There used to be lots of mistakes and a much lower standard in all the work done. Now it is mostly all what even an expert would call 'good' and much of it is excellent."

Chance is still an alluring factor in picture taking, but much of the needless worry of the amateur has been removed by the efficient organizations that serve him. If his camera is not at fault, if he has operated it properly, it is almost a certainty that he will get good pictures owing to the army of trained assistants that are ready to serve him at any hour of the day or night.

With the rapidly increasing number of amateur motion-picture cameras, several developing firms have devised special equipment for making positive films of twenty and 100-foot length of "movies" of vacation scenes and other views prized by the non-professional photographer. One company in Chicago handles more than 200 reels of this kind each week.

Developing wheels, an automatic timer that regulates the amount of light each exposure is given and other apparatus adapted to intensive work of this kind have been installed. Satisfactory enlargements may be made of any exposure in the reel.

Processes have also been devised for coloring the films so that the amateur will have a realistic and durable record of intimate family scenes and is saved considerable time and expense that a plant of his own would require.

Picture from Which Separate Print Was Made for Each Child

WATER-TIGHT CAMERA TAKES UNDERSEA PHOTOS

Intimate studies of the wonders under the waves are afforded through submarine motion pictures taken without elaborate apparatus or diving bells with the aid of a portable camera cover devised by the head of one of the departments of the Smithsonian Institute, in Washington, D. C. The mechanism and film are protected by the water-tight case and its portable construction enables the operator to film scenes and get "closeups" that could not be reached easily with a more complicated outfit. To test the efficiency of the case, the inventor, protected by a diving helmet, descended into the clear waters off the Bahamas, not long ago, and made motion pictures of coral rainbows, blue angel fish, the butterfly fish and "spotted hinds" and "yellow tails" with the camera.

Doctor Paul Bartsch of the Smithsonian Institute with His Submarine Motion-Picture Case

Examining a Length of Film: Camera Open and Shown without Its Water-Tight Submarine Case

STEAM-HEATED ROAD SPRAYER DROPS AND SPREADS TAR

For pouring and spreading melted tar, oil, or similar fluids on road surfaces, a machine has been built that applies the material and distributes it evenly by a series of brushes. The spray tube has a vibrating motion from side to side when in operation to scatter the liquid across its path. Its ends are fitted with collapsible extensions so the length can be adjusted to the width of the highway. Steam heat, to prevent risk of fire, keeps the substances in a thin state. The brush drag is equipped with springs that force the brooms against the surface of the road. The discharging jets are controlled from the driver's position by a lever. Either horses or an automobile truck can be employed to haul the apparatus.

Road Sprayer with Moving Brushes for Spreading Tar or Other Liquids on Highways

MYSTERY NOMADS OF ARCTIC TAKING UP FARMING

Sweden's Lapps, mysterious nomads of the north, are by no means a dying race, and after centuries of wandering are beginning to attach themselves to the soil, according to a government report. In fifty years they have increased in number about fifteen per cent, the official count now being, 8,128. About one-third still roam with their herds of reindeer over the Arctic hills and plateaus, but are declared to be showing an increasing desire to live in real houses instead of their "kaatas," or tepees.

PUPILS WARNED OF MISTAKES BY AN AUTOMATIC BELL

Spanish school children are aided in learning to write by an electric apparatus so adjusted that any mistake made in copying angles, loops and other designs traced on metal plates will be noted by the sharp ringing of a bell. The plates are connected by copper wires to the signal and any deviation from the true outline in copying, causes a circuit to be completed and the alarm sounded. The task is thus made sort of a "game" and the children are furnished an incentive to make their pictures exactly like those on the plates.

WEIGHT LOST DURING SLEEP IS RECORDED BY SCALES

Delicate scales, which show the constantly fluctuating weight of the human body, have been used at the Carnegie Institute to prove that persons lose weight while sleeping. Constant evaporation of moisture from the body while sleeping causes the loss during the night hours, it has been shown, and the deficiency is not balanced by food or water taken as it is in the daytime. The amount of weight reduction while exercising and the changes from one hour to another also are registered by the nicely adjusted balances of the scales.

SERUM TO DISSOLVE CANCER TESTED BY DOCTORS

After ten years of study and experiments, two Vienna physicians have announced that they have found a substance which dissolves cancer cells. In healthy persons they found that the blood serum is able to carry away the growths. The vital fluid of the victims of the disease, however, lacks this power. After many tests, a culture was made that is said to dissolve the malignant cells. It is declared to be an organic acid, the formula of which is carbon, 42; hydrogen, 76; oxygen, 7.

VANITY CASE WORN ON WRIST OR LIKE A LOCKET

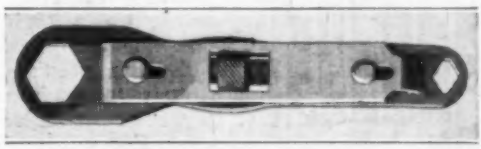
To be worn on a ribbon bracelet, or as a locket hung around the neck, a vanity case recently marketed is designed to carry

Vanity Case Like Wrist Watch that Also May Be Worn as a Locket

its contents conveniently without occupying space in purses or pockets needed for other articles. Used in this way as an adornment, it is always within easy reach and can be quickly opened. Powder, puff and a mirror are provided in the small interior. The outside of the container is finished in either gold or platinum effect. Clasps and ribbons are furnished with the cases so they may be worn as desired.

JAWS OF SLIDING-BAR WRENCH FIT ALMOST ANY SIZE NUT

To fit many sizes of nuts, a wrench has been recently patented that has a sliding beam that adjusts jaws at both ends of the tool. Gripped at the middle, the bar can be easily moved in either direction by turning a thumbscrew. Made of specially treated steel, it is said to resist wear and protect nuts from damage usually caused by pressure from ordinary devices. As an



Two-Piece Wrench with Sliding Jaws at Both Ends that Are Adjusted by Thumbscrew

aid to automobile mechanics, the utensil is claimed to fit almost any square or cornered bolt or nut in a car's mechanism.

Battling Wild Animals to Cure Their Ills

By GEORGE F. MORSE, Jr.
Director, Chicago Zoological Park

ANIMALS in captivity, it has been found, suffer from most of the ills common to civilization. A fairly common trouble that keepers of lions and other members of the cat family have to contend with, is ingrown claws. This condition is caused by the lack of exercise and the absence of rough surfaces to wear them down, with the result that the points grow into the pads or bottom, of the foot.

In a case of this kind in a large zoological park, the animal was so active that it was found impossible to rope it, so the large exhibition cage was battened with blankets and several quarts of chloroform sprayed in before it could be handled. In another instance, a valuable lioness was deprived of food for forty-eight hours, so that when a raw bone, too large to pass between the bars of the cage, was put before her, she ravenously rushed for it and tried to pull it into the cage. In so doing she extended her paws through the bars and obtained a firm hold on the bone. While the animal was thus engaged, the keeper was able, with a pair of long-handled shears, to snip off, and pull out the offending claws.

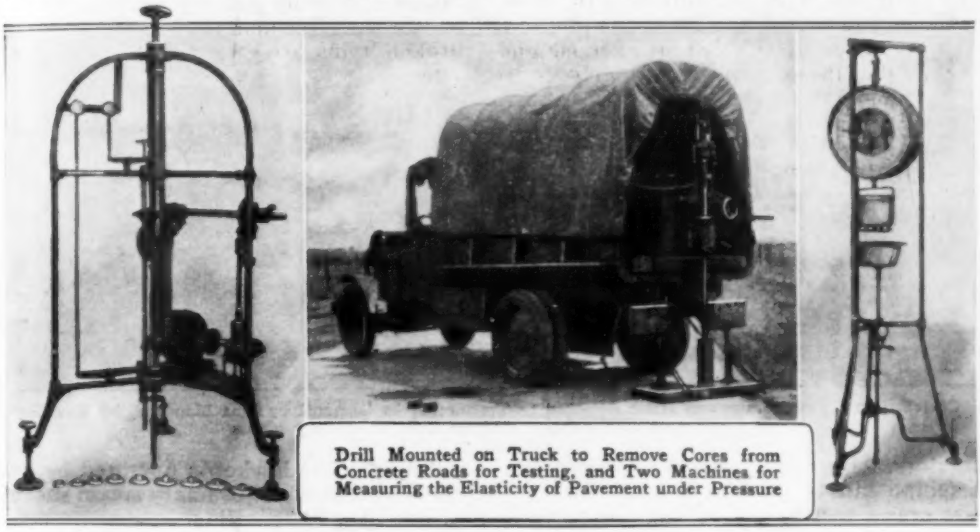
It is readily apparent that arriving at a true diagnosis in wild animals is much more difficult than with domesticated species which usually docilely submit to examination, taking of temperatures and giving of medicine, whereas wild animals struggle fearfully and fight all handling, with the result that they work up a high temperature, quick pulse and often seriously aggravate their trouble. For ordinary ills nature is the best healer, and by helping her out by providing plenty of fresh air, quietness and cleanliness, many troubles are overcome. If drugs must be given, it is necessary to concentrate and disguise them by putting in some tidbit to be eaten. Accidents, such as cuts and broken limbs, are very difficult to treat for after the operation, the animal does not realize what has been done and pulls out stitches or removes bandages and splints, so slings and contrivances have to be made. For instance, a monkey insisted on removing splints from its broken arm and a wide wooden collar had to be put about its neck to keep it from getting its teeth at the bandage.

In another instance, a Himalayan black bear was found stretched out almost lifeless in its cage. The veterinary who was called said that it looked as if the animal had been poisoned, and held out little hope of recovery. The administration of spirits of ammonia was tried as a last resort. After hours of treatment, the creature began to show signs of life. Thereafter it had to be coddled and was almost as helpless as a new-born infant.

There was a paralytic condition of the muscles of the whole body that made it necessary for the keepers to stand over the patient and open the mouth to insert food and medicine. Then the throat had to be massaged downward. After a month the animal recovered its health.

BORING HOLES IN ROADS TO TEST PAVEMENT

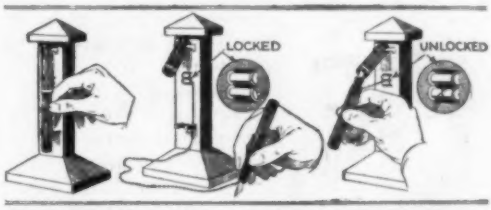
While building and maintaining state highways has in many instances been more or less of a failure, in Illinois success has resulted from a system of testing which prevents the laying of pavement which does not come up to specifications and prevents the fraudulent contractor from cutting out the heart of the political melon. For this work several pieces of apparatus have been invented and developed. Three points which vitally affect the efficiency and lasting qualities of concrete pavement are considered in the tests: First, the bearing power of soil; second, the quality and thickness of the slab; and, third, the surface irregularities which would produce abnormal conditions of loading. To insure all of these factors, two machines have been constructed. One consists of a three-legged iron pipe frame, from which is suspended an automatic scale supporting a pail containing about thirty pounds of shot. Pressure is applied to the concrete and then released and the upward movement of the pavement measured on a dial. This has shown that, with a truck moving down the pavement toward a certain point, the soil beneath is subjected to an increasing pressure which reaches a maximum when the vehicle is directly over the spot. The other machine consists of an iron frame in which is mounted a spring for producing pressure that is exerted upon the soil through a plunger, the movements being recorded on a dial. Experiments are said to have proved that an ideal subgrade is not necessarily one which has the greatest resistance to loads, but one which not only is fairly firm, but is also elastic enough to recover from deformations. The continual movement of the pavement, due to temperature stresses, requires that the earth beneath follow it to some extent. After the roads are finished, a core drill is used to make observations. Concrete plugs are used in filling up the holes made by the drill. When the cores are received in the laboratory they are carefully measured for diameter and tested for compressive strength.



Drill Mounted on Truck to Remove Cores from Concrete Roads for Testing, and Two Machines for Measuring the Elasticity of Pavement under Pressure

FOUNTAIN PEN ON LONG CHAIN PULLS OUT OF DESK HOLDER

For use on desks and in public writing places, a fountain pen attached to a neat holder has been patented to replace unsightly inkwells. A chain that automatically adjusts itself to the desire of the user is fastened to one end of the pen. Finished in bronze, the stand makes an attractive ornament. The pen point is guaranteed and its use is said to result in economy in ink, pen points and holders.



Fountain Pen and Attractive Holder to Replace Inkwells in Public Writing Places

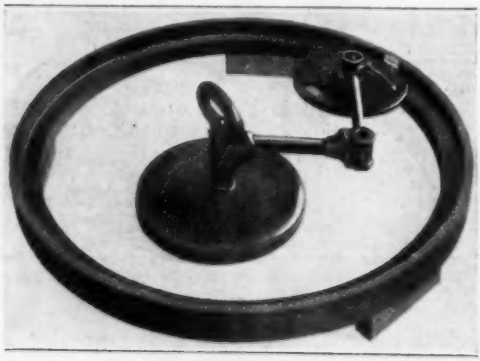
CRANE, HOIST AND SHOVEL COMBINED ON TRACTOR

To help small contractors in making excavations or loading material, and for work in gravel pits and around industrial plants, a combined crane, hoist and shovel has been designed to be attached to gasoline tractors. By unlocking the bucket, the machine can be used as a small locomotive crane, and by unhooking the cable it may be turned into a hoist. The rear wheels are filled with concrete to give greater stability. These may be replaced with weighted rubber tires where it is necessary to run over streets, or the floors of factories. The bucket is operated by one man, like that of the ordinary steam shovel, for handling light loads.

Combination Shovel, Crane and Hoist Attached to Tractor; It Is Operated by One Man and, by Covering the Wheels with Rubber, May Be Used on Factory Floors

DIAL WHEEL MEASURES INSIDE OF AUTO RIMS AND TIRES

Inside circumferences of tires and rims can be measured with accuracy by an instrument being manufactured in Scotland. The ring is laid flat, and the device, which is weighted by its cast-iron base, is placed in the center. A swinging metal arm, holding a dial wheel that passes along the inner surface of the tread, is rotated once around. The reading on the dial shows the distance traveled. Where wide tires are to be tested, two operations are necessary, one on each side of the rim. The results registered by the scale are then compared to insure equal dimensions.



Dial Wheel on Arm that Measures the Inside Circumference of Tires and Rims

ELECTRIC POWER TO TRIPLE IN NEXT TEN YEARS

Owing to the rapid advance in the adoption of electric energy as a source of light, heat and power, it is estimated that more than six billion dollars must be spent for new plants and equipment in the next ten years. During this period, according to a recent survey of the demands from the home, farm, mine and factory, it will be necessary to more than triple the present power output. At present it is estimated that there are almost 500,000 circuit-miles of transmission and distribution lines in the country, or sufficient to encircle the earth twenty times. By 1933 it is believed that this figure will be increased to 900,000 miles, a distance equivalent to almost four times the distance from the earth to the moon. The price of electricity is said to have increased only 5.1 per cent since 1914.

RADIO

Calibrating Stations Chosen

Because of its power and location, which enables it to be heard on both the Atlantic and Pacific coasts consistently, station WLAG, the Twin City (Minneapolis and St. Paul) Radio Central, has been officially chosen by the United States bureau of standards as the central calibrating station for broadcasting signals of standard wave lengths all over the country, so that the 700 or more sending stations and the hundreds of thousands of receiving stations may tune their wave lengths accordingly. KDKA, at East Pittsburgh, has been selected as the eastern calibrating station. This station also broadcasts to the Pacific coast with the aid of its relay station KFKX, at Hastings, Neb. The government started this work in December.

Radio Teaches Deaf

By means of powerful amplifiers, in connection with radio instruments, deaf-and-dumb children in the public schools of Cincinnati, Ohio, are hearing the human voice for the first time in their lives. It is the opinion of the supervisor of music in the schools, who is in charge of the undertaking, that the possibilities of this method of teaching the deaf are unlimited. Our photo shows a teacher, who came to Cincinnati from the California state school for the deaf, talking to a child who never before had heard the least sound.

Teaching Deaf Children by Means of Radio Is Latest Educational Development

The Ideal Radio Set for Hikers

Henry Farkouh, a Brooklyn amateur, is the designer and builder of a novel radio

Complete Radio Set Attached to Canvas Belt, Strong Enough to Operate a Loud Speaker

set that should prove ideal for the hiker. It is a three-tube receiver, operating on small batteries and is complete in all details. The instruments are fastened to a canvas-web belt, and each tube has its own rheostat; a potentiometer is also provided. The set has sufficient power to operate a loud speaker, and it is said that stations as far away as Chicago have been heard on it. The antenna consists of fine wire sewn between two canvas sheets so that it may be carried under the shirt, or in a pocket.

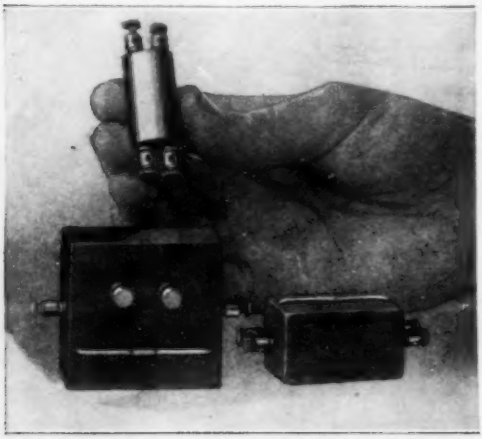
New York Plans Great Broadcasting Station

Fifty thousand dollars have been appropriated for the erection of a great municipal broadcasting station in New York, and soon people all over the country will be able to hear the music the metropolis enjoys, and to listen to the great speakers and artists that visit the country's largest city.

According to Commissioner Whalen, this means that at least 300,000 persons in the city can enjoy the band concerts in the park this summer, instead of only a few thousands around the bandstands, and that a million radio fans throughout the country can hear the famous bands and artists that delight New Yorkers.

The Smallest Radio Set?

What is claimed to be the smallest radio set in the world has been built by an amateur in Providence, R. I. Spurred on by accounts of what others had accomplished in building small sets, he first built a set 2 in. long, 2 in. wide, and 1 in. high. This contained a fixed crystal, a phone condenser, and a single-slide bank-wound coil. His next attempt resulted in a set 2 in. long by 1 in. square, containing everything but the phone condenser, which was discarded as unnecessary. Slider bars on top of these sets permit tuning up to 500 meters.



Interesting Examples of the Amateur's Skill: The Smallest Set Is but 5/8 Inch in Diameter

Even the second was not small enough, so a third set was built, which can be covered completely with four postage stamps, one on each side. It is 5/8 in. in diameter and 1¼ in. long. On this set concerts broadcast within a radius of 20 miles can be heard distinctly.

¶In Sweden plans have been made to erect a limited number of broadcasting stations, which are to be leased by the government to private operating concerns. The privilege of owning a receiving set will also be restricted to those obtaining a permit upon payment of a license fee.

Miners May Carry Small Receiving Sets

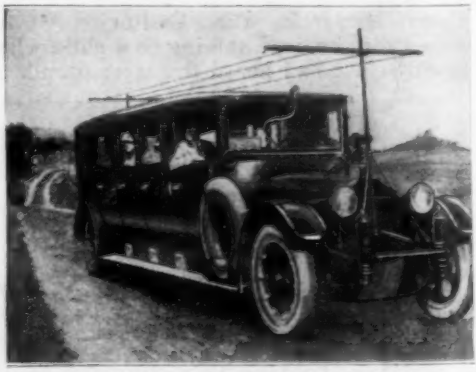
Experiments of far-reaching importance to miners, caisson workers, and divers were recently carried out in New York, when, in a dripping tunnel 90 ft. below the surface of the Hudson river, and 1,600 ft. from the nearest exit, a group of officials tuned in concerts broadcast from Pittsburgh and a number of nearer stations. The programs were heard distinctly, in spite of the 30 ft. of water, 60 ft. of earth, and several inches of reinforced concrete between the instruments and the outer air. This convinced the engineers in charge of the test that radio is quite practical for communication between the surface and entombed miners, or deep-sea divers.

M. M. Frolich, secretary of the New York state bridge and tunnel commission, said at the conclusion of the test: "Our divers, and caisson workers, whose lives are often imperiled or lost when the telephone lines they communicate with are swept away, may carry small portable transmitting and receiving sets that will make them independent of all other means of communication."

This is said to be the first successful test of underground radio reception, and was conducted with stock apparatus. A strange coincidence was that the first number heard was a lecture on "Safety First."

The Radio Bus Is Here

Passengers of bus lines in California are now being served with free music during their trips as a result of the enterprise of a motor-transit company.



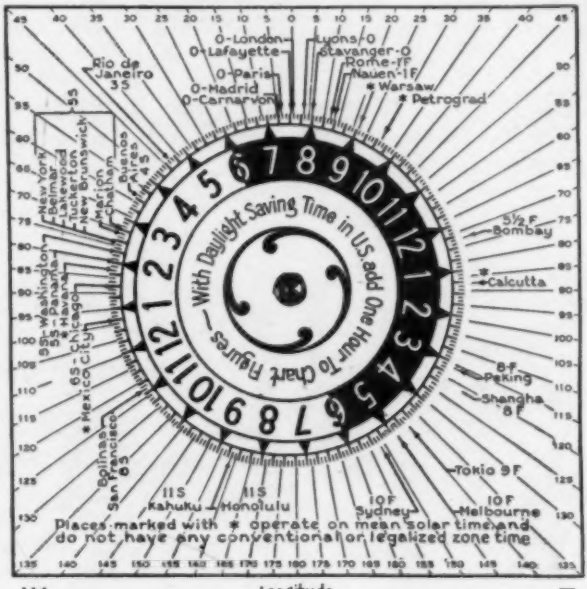
Busses on Sacramento Road in California Are Equipped with Radio Sets

On a run to Sacramento, the bus was able to pick up concerts broadcast from Oakland and San Francisco, using only a two-step amplifier and a short aerial.

Chart Tells Time All Over World

Station WGY, the General Electric broadcasting station at Schenectady, N. Y., puts out a very interesting world-time chart, a reproduction of which is shown in our illustration.

It consists of a central circular disk, graduated into day and night hours, mounted on a chart showing the time in various cities throughout the world. The manner in which it is used can best be described by an actual illustration: Supposing it is 7:00 p.m. in New York and it is desired to know what time it is in San Francisco. The black portion of the disk represents night hours, so the disk is revolved until the 7 in the black space is opposite the line marked New York. Opposite the line marked San Francisco will be found 3:45 in the white portion of the disk, so it is 3:45 p.m. in that city. Similarly 7:00 p.m. in Chicago is approximately 4:40 p.m. in San Francisco.



Our Readers Can Obtain a Copy of this Handy Time Chart from Station WGY, at Schenectady

Opposite various cities on the chart are found figures, followed by the letter F (Fast), or S (Slow). These indicate how many hours the clock time in any city is ahead or behind the clock time in London at any moment. Thus, New York, Marion, Chatham, etc., are marked 5 S; that is, 5 hours behind London time. Noon in London is 7 a.m. in New York.

Any of our readers can obtaina copy of thi schart by writing to Station WGY, at Schenectady.

Finger Touch Operates Vernier Dial

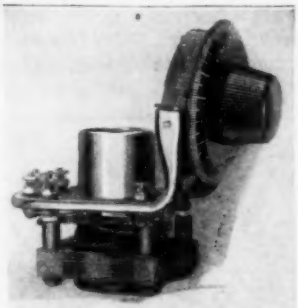
Coarse adjustments, with a new vernier dial, are made with the hand on the knob in the usual manner. To obtain the vernier action all that is necessary is to drop the hand to the small knob and press it slightly upward; this engages a small pinion with a large gear on the back of the dial, and permits the minutest adjustment in either direction. As the hand in making the fine adjustment is at a considerable distance from the device being tuned, capacity effects are reduced to a minimum. A further advantage is that the fine adjustment may be made over the entire scale of the dial, enabling very sharply tuned stations to be "brought in."

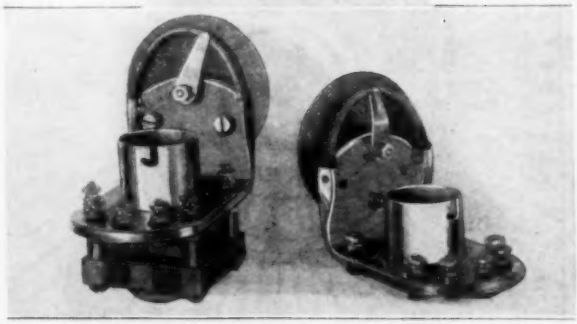
Six Phones Used in One Plug

Any of our readers can obtain a copy of this chart by writing to Station WGY, design. The plug is made in three types: one for panel mounting, one for connecting to binding posts, and one with a standard plug stem for use in a jack. The heavy molded-insulation body contains six terminal holes; one tip of the phone cord goes in a hole, the other is inserted under a spring-steel strip fastened around the outer edge of the plug, connecting the phones in parallel-series.

Compact Radio Units Aid Assembly

Builders of homemade radio sets will be interested in a remarkably compact and attractive radio unit now on the market. The units are built in two styles, for detector and amplifier. The detector unit consists of the tube socket and rheostat in one mounting, complete with knob and dial. The amplifier unit has also the tube socket and rheostat, and, in addition, the audio-frequency transformer mounted directly below the socket. The whole assembly is fastened to the panel with only two screws, thus saving a great amount of time in assembling. All metal parts are nickel-plated, and the units present an unusually neat appearance.





Rheostat and Tube Sockets of Compact and Neat Design, Attached to Panel by Only Two Screws

One-Wire Antennae for Merchant Ships

Exhaustive tests recently carried on with one-wire antennae on merchant vessels show that they are practicable for low-power transmission and for receiving purposes, although their efficiency is slightly less than that of the three and four-wire antennae generally used. But this slight loss of efficiency is compensated for by the reduced cost, space, and weight of the one-wire antenna, and this means much on cargo ships on which it is customary to lower the antenna during loading operations. The one-wire antenna can also be hoisted much higher than the three or four-wire antenna because it is lighter. The latter has been found the most satisfactory.

Mystery of Arctic Barrier Baffles Radio Experts

Since July, 1922, when the Maud, Amundsen's exploration ship, made its dash northward, and became frozen in the ice in latitude 78° north, longitude 165° west, the ship's radio has been sending out two messages a day. These messages have been received by nearly all stations in Europe, across the North Pole, but they have not been received in Alaska, the United States, or Canada.

MacMillan's ship, the Bowdoin, now frozen in at Refuge Harbor, latitude 78.30 north, longitude 72.30 west, has found that the only station with which it can communicate regularly is that of Jack Barnsley, station 9BP, of Prince Rupert, B. C., and since Sept. 7, 1923, all press stories from the Bowdoin and all messages to and from it have been handled through Barnsley. Other stations have heard WNP (the Bowdoin) but all report very unsatisfactory reception, and 9BP is the only one to get messages through to WNP.

Why is this? That is the question radio experts are asking. What mysterious, invisible barrier prevents these messages from reaching this country? Is it the influence of the aurora borealis or the magnetic pole that causes a "dead spot" surrounding the pole on this hemisphere? These questions the Aerial League of America has set itself to solve, and the cooperation of all radio amateurs is invited in the tests. Prizes will be offered by the league for the best reports of experiments by amateurs.

The object of the research work is, first, to ascertain the effect of daylight, twilight, and darkness; ice, water, snow, verdure, atmospheric conditions and geological formations on radio. Second, to ascertain and define the location and strength of natural disturbances and interferences acting upon receiving stations all over the world, under various conditions. Third, to locate and map the "dead areas" of the earth, and delve into the causes of the mysterious barriers to radio transmission. Fourth, to find out whether radio signals travel equally rapidly through earth, air, and water. The subject is an interesting one, and the results of the work should be very valuable.

TWO SIMPLE REGENERATIVE RECEIVERS

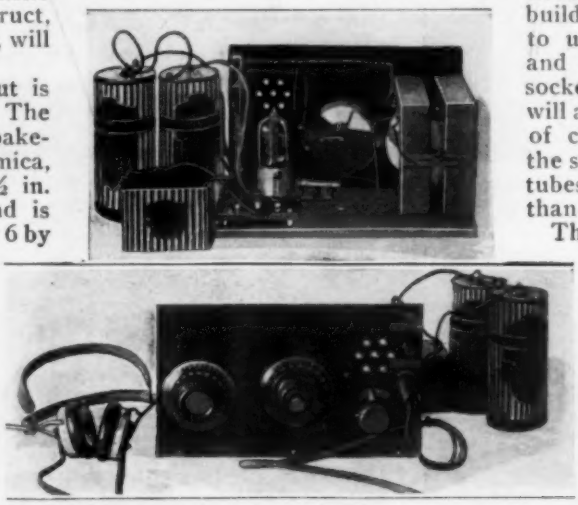
By F. L. Brittin.

Part I—The Ultra-Audion

MANY radio enthusiasts who are now using crystal receivers would gladly substitute a tube for the detector, were it not for the expense and inconvenience of the storage battery. Of course, the 1½-volt tube has been available, but many people wanted something more nearly approaching the efficiency of the 6-volt tube. For the radio fan of this type there is now available a dry-cell tube—the Radiotron UV. 199 or Cunningham C. 299—the filament of which requires 3 volts, and is supplied by two dry cells. These tubes draw only .06 amp., so the drain on the cells is very light, and they are superior in performance to the 1½-volt tubes, approaching more nearly to the 6-volt tube. The two types of receiver described in this article are well adapted to these tubes, and give excellent results. The ultra-audion circuit, which is a little simpler to construct, and easier to tune, will be described first.

The panel layout is shown in Fig. 1. The panel may be of bakelite, radion, or formica, 3/16 by 6½ by 10½ in. in dimensions, and is fastened to a ⅜ by 6 by 10-in. baseboard by three ¾-in. round-head nickel-plated screws. The entire instrument may be mounted in a cabinet, if desired, in fact, this is recommended, as it keeps dust out of the various instruments in the set.

Drill all holes in the panel for mounting the instruments before screwing the panel to the baseboard, pricking off the location of the various screwholes with a scriber and marking each center with a center punch, so that the drill will not slip and mar the panel.



Photos of Front and Rear of Simple Receiver Incorporating the Ultra-Audion Circuit

The variometer used in this circuit is of the ordinary type, but care should be taken to select a good make. This applies to all instruments used in a radio set, by the way; there are many cheap parts on the market, but the best will be found cheapest in the end. If cheapness is essential, a good wooden variometer should be selected, if not, use the best molded type available. The use of a variometer eliminates all taps and multi-point switches, and adds greatly to the simplicity of the circuit. The rheostat used is of the ordinary panel-mounting type, and should have a resistance of 40 ohms. The grid condenser is of .00025 mf. capacity, and the grid leak of 2 meg. resistance; these are a standard single-unit type. The socket may be of the ordinary type; this necessitates an adapter for use with the 3-volt tubes, but this is an advantage, as the builder may later wish to use a 6-volt tube, and if a standard socket is used at first, it will avoid the necessity of changing later, as the sockets for dry-cell tubes are smaller than the standard.

The phone jack is of the open-circuit type. The variable condenser is a standard 23-plate one with vernier, and the remarks previously made with reference to selecting the variometer apply to the condenser also. The binding posts for the A and B-batteries are mounted on a small strip of bakelite 3/16 by ¾ by 3¼ in. in size, raised from the baseboard on fiber collars or sleeves.

The negative lead of the A-battery is connected to the first post; the A-battery positive and B-battery negative leads go to the center post. It will be noted that

the B-battery negative is shown connected to the A-battery lead; this is merely to save confusion on the drawing, and, in practice, both leads go to the binding post. The positive B-battery lead is connected to the remaining post; when the battery is new and fresh, the 18-volt tap will probably be found sufficient, but as the battery grows older, the 22½-volt tap should

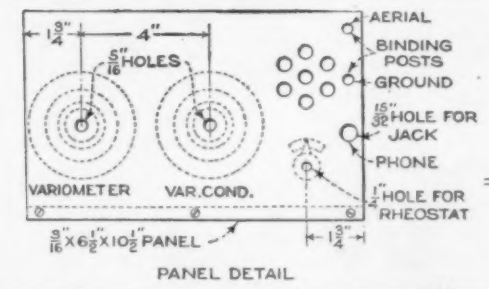


Fig. 1

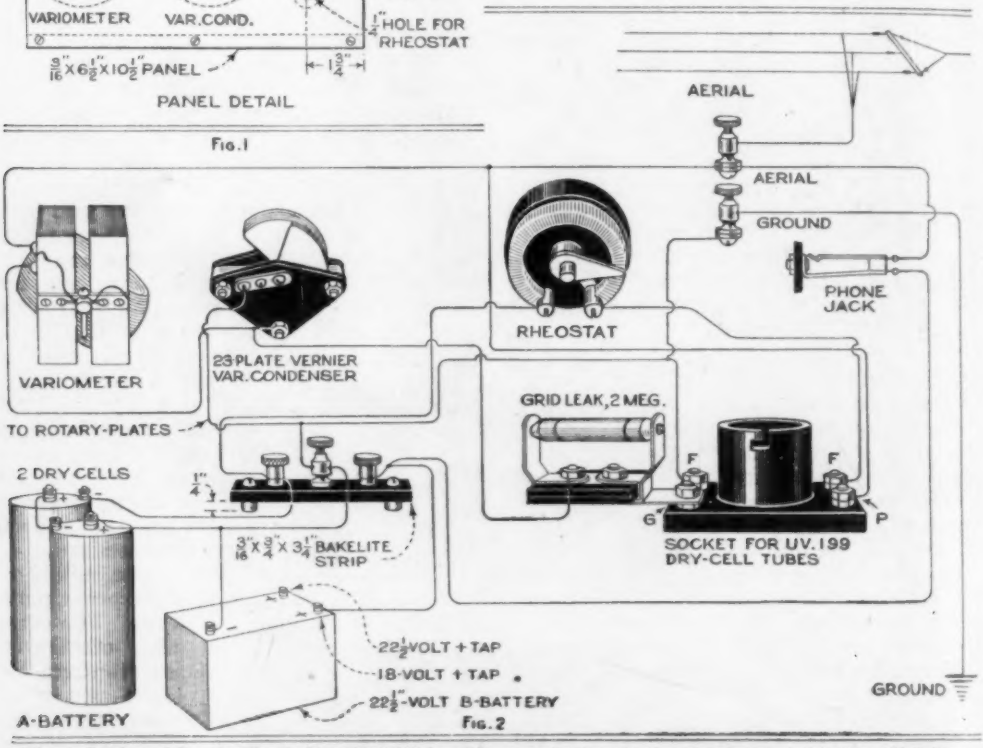


Fig. 2

Fig. 1, Layout of Panel; Fig. 2, Simplified Wiring Diagram of Ultra-Audion Receiver Suitable for 3-Volt Dry-Cell Tubes. Variometer and Variable Vernier Condenser Are Used for Tuning

be used. The active life of a B-battery with this set is about 9 months, and, as the tubes draw little current, the life of the A-battery will be found long enough to make the dry cells quite economical. It will be noted that the dry cells are connected in series, to provide the necessary 3 volts. Use nothing but a good make of phones, of at least 2,000 ohms resistance.

Use No. 18 rubber insulated fixture wire for the circuit, and solder each connection carefully. Use a good non-corrosive flux and plain wire solder. In no case use an acid flux for soldering connections on a radio circuit; rosin-flux paste or any of the good soldering solutions for this purpose on the market should be used. Always scrape the wire bright, use plenty of flux, and keep the copper clean and hot. Poorly soldered connections, usually due to imperfect cleaning of the wire, are the principal causes of poor results in homemade radio sets.

This instrument is very selective, and for performance and economy is hard to beat. The tuning is accomplished by means of the variometer and condenser and the wave-length range, with the ordinary aerial, is from 175 to 550 meters. Stations up to 1,000 miles have been received clearly on this set, with a good pair of phones.

A word of caution is necessary to those who have not built a set before: Check each wire carefully against the diagram before finally soldering it in place, and, before the tube is put in the socket, see that the rheostat is turned to the off position, then, after placing the tube, turn it up slowly until a slight "hiss" is heard in the phones. Turn the rheostat back until the hiss just disappears; this is the operating point of the tube.

The second part of the article, to be published in May, will describe the construction of a simple form of triple-coil receiver made of scrap material.

MATERIAL LIST
Ultra-Audion

1 3-16" by 6½" by 10½" bakelite panel.
1 ⅜" by 6" by 10" baseboard.
1 3-16" by ¾" by 3¼" bakelite strip.
1 open-circuit phone jack.
1 standard variometer.
1 23-plate variable vernier condenser.
1 standard socket.
1 adapter for UV. 199 or C. 299 tube.
1 .00025-mf. grid condenser with grid-leak mounting.
1 2-meg. grid leak, cartridge type.
1 dry-cell rheostat, 40 ohms resistance.
1 UV. 199 or C. 299 tube.
2 dry cells.
1 22½-volt B-battery unit, small type.
5 binding posts.
1 lightning arrester.
1 ground clamp.
1 pair 2,000-ohm headphones.
20 ft. No. 18 rubber-covered fixture wire.
100 ft. aerial wire.
50 ft. lead-in. wire.

Naval Radio Makes Money

In spite of the fact that the naval radio service avoids competition with commercial companies, a recent report shows that the service earned nearly $300,000 in 1922.

Wherever an emergency exists that the commercial companies cannot handle, or where it is possible to help business men extend American trade, the government is always ready to be of service. Many of the commercial messages handled are from business men trying to establish trade connections by radio in places not served by civilian companies.

Remarkable feats in quick transmission are accomplished by the naval service. On the occasion of a recent big sporting event in this country, extra newspapers containing the result were on the streets in Honolulu 50 minutes after the end of the game.

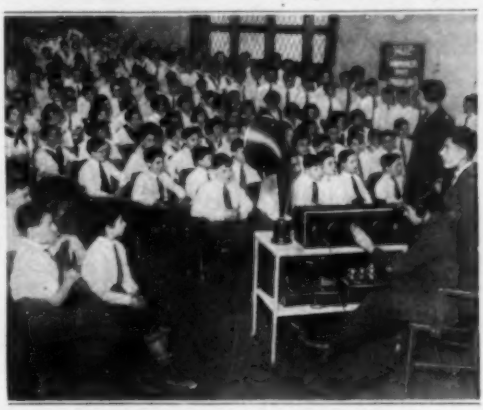
Had the entire business of the bureau, consisting of the transmission of 16,000,000 words, been based on commercial rates, over $4,000,000 would have been earned.

Sea Shell Is Used as Loud Speaker

It is always refreshing to see a departure from the conventional, provided, of course, that the new arrangement works as efficiently as the ordinary one. The sea-shell loud speaker shown in the photograph is not only attractive in appearance, but its acoustic properties are fully as good as those of the common type, which is in many cases, to say the least, an uninspiring object. The base of the shell has been cut off square, and a type-C unit cemented in place, making a novel addition to the set.

Music Lessons by Radio

Pupils of Junior High School 61, in New York, recently had a treat when music broadcast from the Metropolitan Opera House was picked up on a receiver in the classroom, and made a part of their regular music lesson.



Class in New York High School Listening to Grand Opera Company

The experiment was very successful, and it is hoped to make this a regular feature of music work in the schools. The advantages of radio in educating the musical taste of students in this manner are apparent, as it permits thousands of school children to hear the best music, at a nominal expense.

His Voice over Radio Wins Pardon

Max Sasanof, a Russian tenor and painter, who was serving a 5-year sentence at the Atlanta federal penitentiary, recently won a pardon through radio. It became evident during one of WSB's prison concerts that he was an artist of no mean ability, and much interest was aroused in his case. Upon investigation it was found that Sasanof had been the victim of confederates in a counterfeiting plot, and he was immediately pardoned.

Listen for These Foreign Broadcasting Stations

Below are given some of the foreign broadcasting stations that send out programs more or less regularly:

2 LO, London, Eng. 360 meters. Concerts, weekdays from 10:30 to 11:30 a.m., and from 12:00 noon to 5:30 p.m. Also 6:30 to 7:30 a.m. weekdays, and 10:00 a.m. Sundays.

5 WA, Cardiff, Wales. 353 meters. Same program hours as above, with the exception of the 6:30 to 7:30 weekday program, and the 10:00 a.m. Sunday one.

2 ZY, Manchester, Eng. 385 meters. Same hours as 5 WA.

5 NO, Newcastle, Eng. 400 meters. Same hours as 5 WA.

5 SC, Glasgow Scotland. 415 meters. Same as 5 WA.

5 IT, Birmingham, Eng. 420 meters. Same as 5 WA.

SPE, Rio de Janeiro, Brazil. 450 meters. Portuguese language. Exchange quotations, 12:00 noon and 4:00 p.m. Weather forecast, 2:00 and 7:00 p.m. Musical, 6:00 p.m.

Telegraph School of France. 450 meters. 2:30 p.m. Tuesdays and Thursdays, and 8:30 a.m. to 1:00 p.m. Saturdays. Announcements in French.

Station **"Radiola Riviera,"** Nice, France. 460 meters. About 7:00 a.m., 12:00 noon, and 4:00 p.m. News and announcements in French.

HB1, Geneva, Switzerland. 900 meters. 12:00 noon to 2:30 p.m., daily, in French.

Station at **Kbel**, near Prague, Czecho-Slovakia. 1,000 meters. News, concert, and weather report daily at 1:20 p.m. In Czech and German.

PCKK, Velthuyzen station, the Hague, Holland. 1,050 meters. Concerts Fridays, 2:40 to 3:40 p.m. In Dutch.

PCUU, Huessen station, the Hague, Holland. 1,050 meters. Concerts Tuesdays, 1:45 to 4:00 p.m. Sundays, 3:40 to 4:40 p.m.

PCGG, the Hague, Holland. 1,050 meters. Concerts Sundays, 9:00 to 11:00 a.m. Mondays and Thursdays, 2:40 to 3:40 p.m.

PA5, Amsterdam, Holland. 1,050 meters. News and concerts Wednesdays, 2:10 to 3:10 p.m.

PCMM, Ijmuden, Holland. 1,050 meters. Concerts Saturdays, 2:40 to 3:40 p.m.

BAV, Brussels, Belgium. 1,100 meters. Concerts Tuesdays and Thursdays, 4:00 p.m. Sundays, 1:00 p.m. In Belgian.

OPO, Haren, Belgium. 1,300 meters. Weather report (in French), 7:00 a.m. and 11:00 a.m.

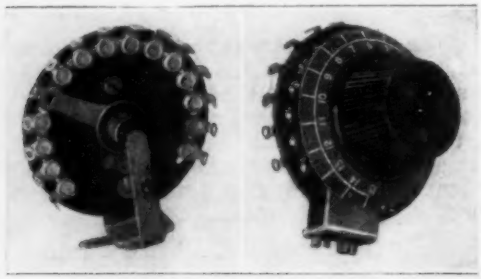
SFR, Paris, France. 1,780 meters. Concerts (in French) weekdays, 6:00 a.m., 11:15 a.m., 3:00 to 4:00 p.m. Sundays, 8:00 to 10:00 a.m. and 3:00 to 4:30 p.m.

As the majority of broadcast receivers in this country will not tune over 1,000 meters, this includes all they may expect to hear, but if any reader wants the remainder of the list it will gladly be supplied, on request.

The times given are Eastern standard time. (New York time.) For Central time (Chicago time), subtract one hour; for Mountain (Denver) time, two hours, and for Pacific (San Francisco) time, three hours. To find the time in Europe, add five hours to the figures, for England, France, Belgium, and Holland. The time in Czecho-Slovakia may be found by adding on six hours. Rio de Janeiro is about two hours ahead of New York; when it is 12:00 noon in New York, it is 2:00 p. m. in Rio.

Switch Aids Tapping of Inductances

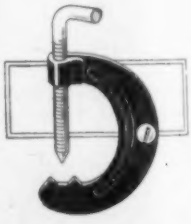
Tapping and wiring of inductance coils is greatly facilitated by the use of a special switch recently placed on the market. Instead of drilling a hole on the panel for each switch point as is usually done, only three holes are drilled, one for the switch shaft, and two for the attaching screws. Contact to each point is made by a switch arm on the back of the unit; there are 15 contact points, and adjustable stops are provided so that any number of points may be used.



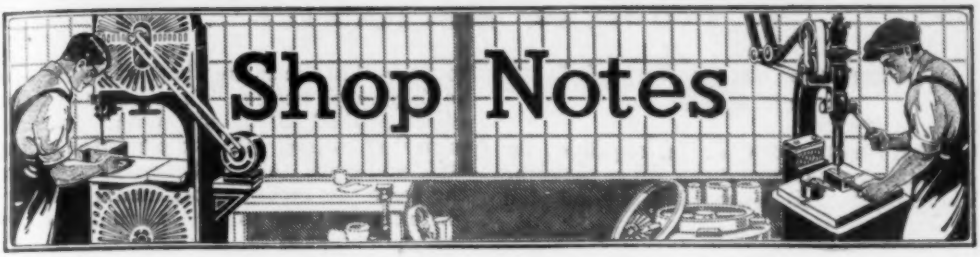
Left, Back of Inductance Switch, Showing Contact Points; Right, Graduated Dial and Knob

Ground Clamp Bites into Clean Metal

A novelty in ground clamps is one that makes it unnecessary to scrape several inches of paint from a pipe to secure good electrical contact. The fitting is made in the form of an ordinary C-clamp, but the end of the screw is hardened and pointed, so that it bites into clean metal with a slight pressure on the screw. The other end of the clamp frame has two small points that also aid in attaining a good contact. The ground wire from the radio set is fastened under a round-head screw in the center of the clamp frame.



¶ Don't attempt to use the lighting circuit as an antenna without first finding out the principles of the idea. One fan did, with the result that his hands were badly burned, and the fire department was obliged to render first aid to both fan and house.



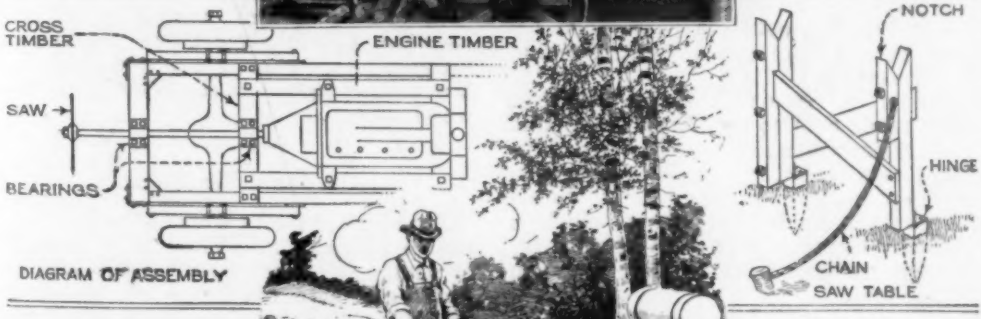
All Shop Notes published in 1923, in book form—from our Book Department.

Wood-Sawing Rig Made from Old Car

By L. B. ROBBINS

INSTEAD of spending from a hundred and fifty to two hundred dollars for a portable wood-sawing rig, a Cape Cod man made use of the power plant of an old car. It has been in use for several years, and will saw up the largest piece of cordwood with ease. The outfit, minus the saw and such parts, cost less than fifty dollars.

An old auto-truck frame with only the rear wheels left on was utilized for the portable foundation. The front cross member of the frame was sawed off, thus making a pair of shafts, into which could be hitched a horse for drawing the outfit around.



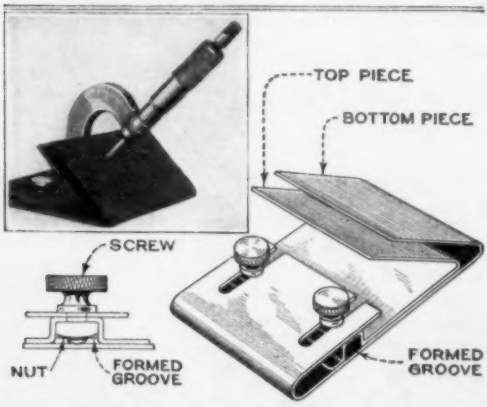
The engine, including radiator, transmission housing, dashboard, and gas tank, is mounted by means of bolts to heavy timbers attached to the chassis, as shown in the illustration. Low and reverse gears are removed, and the driving shaft run through two pillow-block bearings, one bolted to the rear cross timber, and the other to the cross member of the truck frame. The end of the shaft is threaded to take the flanges and retaining nut of an 18-in. circular saw. Spark, choke, and throttle rods are held under cleats on the timbers, and can be adjusted at will.

The saw table consists of a rectangular wooden frame, with deep notches cut in the top of the vertical members to take the sticks. The bottom is hinged to stakes which can be driven in the ground next to the saw, and the table is then ready for use. A chain keeps it from swinging back too far when a heavy stick is being sawed up, besides holding it in position ready for the sticks to be placed on it and pushed over against the saw. The chain is securely attached, by means of a staple, to a stake driven into the ground on the side of the table away from the operator.

Details and Photo of Portable Wood-Sawing Rig Made from Old Automobile: Left, Plan of Assembly; Right, Details of Saw Table

Micrometer Holder Keeps Oil from Spindle

When a micrometer is required for measuring work produced on a machine where cutting oil is used, it is a good plan



Simple Holder for Micrometer Used to Gauge Oily Work

to have some special device for holding it so that the oil will drain away from the spindle. As everything, including the operator's hands, is covered with oil, it is nearly impossible to keep the tool clean, but with a holder of the kind shown in the photo, the tool can be held in such a position that the oil will drain away from the thread, which would otherwise soon become inaccurate, due to the impurities that the oil contains.

The holder is made of two pieces of sheet metal, bent to the shape shown and held together with two thumbscrews, turning in nuts placed in a groove formed in the top piece. The bottom piece is slotted to make the holder adjustable, which is necessary to make the holder suitable for different settings of the micrometer on various jobs.

Increasing Orchard Yield

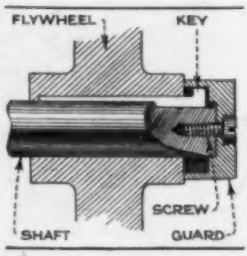
Farmers and orchardists in the United States are beginning to realize the necessity of restoring plant foods to the soil by applying concentrated fertilizers. Nitrogen is one of the foods that every plant needs and one that is soon exhausted from the soil, necessitating fertilizers, such as ammonium sulphate, sodium nitrate, and Chile saltpeter. Sodium nitrate is in such a form that it can readily be assimilated by the tree roots, while ammonium sulphate is slightly less soluble. When using these fertilizers in orchards the best results will be obtained if they are applied to the soil in the spring, just when the season's growth begins. The amount of fertilizer applied to the soil under each tree varies, of course, with the condition of the soil, and with the kind, age and size of the trees. In recent experiments with apple trees on poor soil it was found necessary to apply ¼ lb. of fertilizer for each newly planted tree, and about 15 lb. for each mature tree that had been unproductive.

Cast Copper Vise Jaws

A large shop supplies its bench hands with copper vise-jaw pads to fit the different vises. They are cast from a metal pattern as shown in the illustration, and a good supply is always kept on hand so that a new set can be obtained when the old ones become badly battered and worn. The old ones are then returned to the foundry as scrap copper and recast. Any alloy metal, or even lead, may be used for this purpose, the lead being of special advantage for some classes of work. The pads are placed in the vise and the projecting ends are bent back over the jaws. Copper pads seem to stay in place much better than those made of sheet metal and they also last much longer.—H. L. Wheeler, Westwood, Mass.

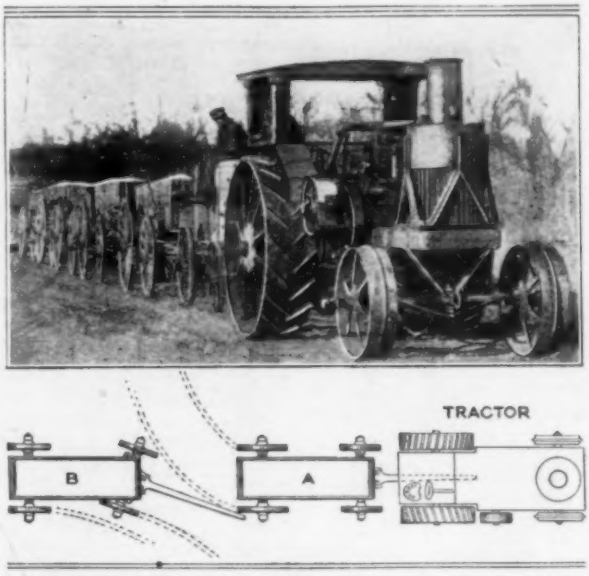
Gib-Head Key Guard

An effective guard for gib-head keys of the kind shown in the illustration not only prevents a loose key from coming out, but it also eliminates the danger of having the projecting head of a revolving key catch the workman's clothes, consequently causing injury. The guard consists of a cast-iron cap fastened on the end of the shaft so that it covers the head of the key. The cap is attached by means of a machine screw driven into a hole drilled and tapped in the end of the shaft. The hole in the cap is counterbored to take the screw head.



Hitching Wagon Train to Tractor

Hauling grain, corn and other products of the farm with trucks is the most modern method, but it is questionable whether a train of wagons drawn by a tractor is not a still more efficient one. Although the time consumed in making the trip with a tractor is much longer than if the trip were made with a truck, a tractor can draw a number of loads at once while the truck must make a separate trip for each load. The only objectionable feature in the use of a tractor for such purposes is its clumsiness, which makes it difficult, and in some cases impossible, to pull the loaded wagons on the grain-elevator platform. Of course, much depends on the particular size and type of the tractor.

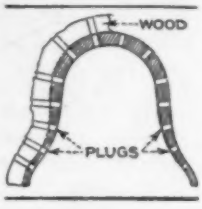


Above, Tractor Pulling 408 Bushels of Corn in Six Trailers; Below, Method of "Hooking Up"

In the case shown in the photograph six wagons, loaded with shelled corn, having a total weight of 408 bushels, were drawn by the tractor. It was necessary to hitch the wagons as close as possible so that corners could be turned safely. To do this the tongues were securely fastened to the front axle support of the wagon ahead, instead of the rear one as is customary. In order to avoid the necessity of moving the wagons by hand the tractor was backed up in front of the first wagon, A, and its tongue was attached to the drawbar of the tractor, as indicated by the dotted lines of the detail. The first wagon was pulled up to a position directly in line with the second wagon, B, the tongue of which was cramped hard over. B was then backed until the tongue could be straightened, and A backed so that the two could readily be hitched as described above. This operation was repeated for each wagon which could not be hitched before it was loaded. A team of horses drawing another wagon load was taken along with the train so that it could be used to pull the wagons on the elevator platform separately after they were unhitched; this could not be done by the tractor, owing to its size.

Turning Bell Pattern to Size

In making a pattern for a large bell difficulty was encountered, after the inside was finished, in turning down the outside to the proper size, as no calipers that were large enough were available. The difficulty was overcome by drilling a number of holes through the pattern about 3 in. apart, and inserting plugs of a length equal to the desired thickness of the pattern at various points. The pattern was then mounted in the lathe and the excess thickness turned down until the outer ends of the plugs were flush with the surface.—A. E. Holaday, Springfield, Massachusetts.

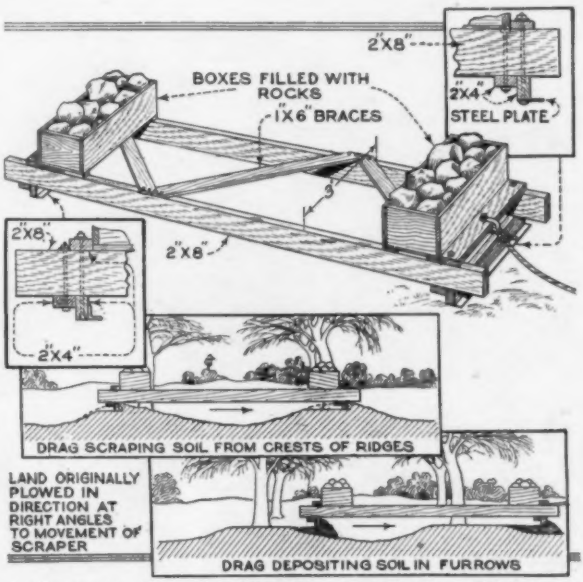


New Use for Sandblast

A novel application of the sandblast has been discovered by an English company—that of cleaning boiler tubes. It is claimed that the tubes of modern tubular boilers are rapidly cleaned of soot, etc., on the outside, and that the interior of each tube can be cleared of scale or other deposit thoroughly, and at a much greater speed than by any other existing method. This certainly has the merit of simplicity.

Homemade Drag for Leveling Orchard Land

After experimenting with several kinds of drags, the one shown in the illustration was found the most serviceable and convenient for leveling orchard land, which in this case, had been plowed the same way for several years with the result that the surface was formed in a series of ridges and furrows. Although a drag of this kind may not level the ground perfectly it will, nevertheless, help considerably. The work must, of course, be done when the soil is still loose from harrowing, before the winter rains pack it down.



A Homemade Drag that Has Been Found Very Efficient for Leveling Orchard Lands

The frame of the drag is made of two timbers of 2 by 8-in. pine or similar strong material, and four 2 by 4-in. crosspieces, two of which are bolted at each end, the upper one flat and the lower one on edge, as shown in the upper right-hand detail. The length of the drag, or rather the distance between the crosspieces at the ends, should be equal to the distance from center to center of the orchard ridges, and this depends, of course, on the distance between the rows of trees. About 3 ft. is the best width unless a tractor is used, and then the drag may be wider and also much heavier. A 2 by 4-in. reinforcing block is bolted behind each lower crosspiece to prevent it from being torn off while dragging. Diagonal braces of 1 by 6-in. material or lengths of angle iron are bolted across the frame to prevent distortion, but heavier timbers, say of 2 by 4-in. material, would be better, as there is a considerable strain on the drag when it is turned. A box is nailed at each end and filled with stones to give the drag the necessary weight. Steel plates, ¼ in. thick, or lengths of angle iron are bolted to the edge of the lower crosspieces, as shown, so that the drag will take a good "bite" when scraping the soil. One horse can readily pull a drag of this size. If a team or tractor is used more ballast may be added.

In use, the crosspieces scrape soil from the crests of the ridges and deposit it in the furrows. Some difficulty in the use of this drag is encountered in turning, but this can be eliminated by making the drag "double-ended" so that it can be pulled back without turning.—H. H. Parker, Los Gatos, Calif.

Cutting Washers in Lathe

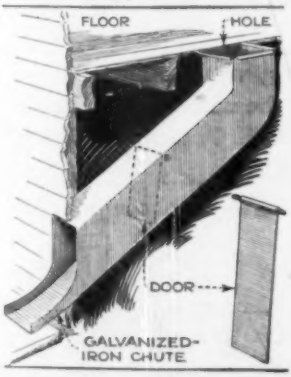
There are all sizes of washers on the market, but it is often difficult to get one to fit snugly, because the shaft or spindle on which the washer is to be used is sometimes worn down a trifle below the nearest standard size of washers, or the particular size of the washer needed may not be available, making it necessary to cut an emergency one. An excellent method of cutting washers accurately to any desired size and without much trouble, is to do it on the lathe.

The material from which a washer is to be cut, whether felt, fiber, rubber, leather, etc., or even thin sheet metal, such as brass, copper and tin, is tacked to a wooden disk about ¾ in. thick, which is mounted on the screw faceplate of the lathe. The tail center is then moved forward to mark the center on the disk and a pair of dividers are used to mark the inside and outside diameters, which is done in the following way: The diameter of the shaft is measured with a slide caliper and the dividers set to slightly less than half of this distance, to insure a tight fit. Then with one

point of the dividers on the center mark just made on the disk a circle is carefully scribed on it, holding the dividers on the toolpost at an angle to the work, and revolving the faceplate slowly by pulling the belt. If the impression of the divider is not distinct enough, it can be brought out by running over it with a sharp-pointed pencil. The outside diameter is then scribed by setting the dividers to one half of this distance and proceeding in the same way. The lathe is set in operation and a sharp knife used to cut out the washer, the knife being steadied on the toolpost. It is obvious that the inner circle must be cut first. In cutting washers from soft materials such as felt, cork and rubber, which cannot readily be marked with the dividers and are not easy to cut, a stiff piece of cardboard is tacked over the surface and this surface used to mark on and cut through; the result will be that the material under it will be neatly cut to the same size. The size of the washers that can be cut in this way is limited only by the size of the lathe used to do the work. When cutting brass, copper and tin washers a regular metal-cutting tool must be used instead of a sharp knife.—J. E. Decker, Chicago, Ill.

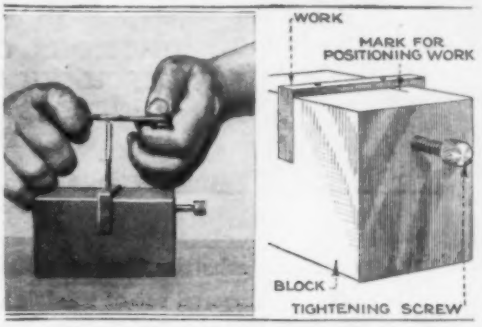
Cold-Air Check for Chute

In a manufacturing plant where finished slabs are conveyed from the inside through a chute to the outside, a cold-air check was installed to prevent too great a loss of warm air in winter. The chute is made of galvanized iron and is nearly square in cross section. The check is also made of sheet iron and is slightly smaller across than the inside width of the chute, but is about an inch longer. The upper edge is bent over to hinge on a wire that is run through the chute and is fastened on both sides. When the check is at rest, the lower or free edge is a little further out than the top; this prevents it from swinging inward and effectively keeps out all cold-air drafts. Still it does not interfere with the passage of the slabs in any way.



Preventing Tap Breakage

It often happens that a small tap suddenly breaks after it has been used constantly on the same kind of work. The breakage is most likely due to too much torsional strain. Breakage of taps due to this cause can be eliminated by providing a loose block to hold the work; then if the tap binds in the work, the whole block will turn. The block is simply a piece of cast iron with a groove or slot cut in it to hold the work and a tightening screw to hold it securely. The block is placed on the bench plate and the friction between the block and the plate is sufficient to hold the former stationary while the tapping is being done. By moving the work so that the hole to be tapped is eccentric, the block can be adjusted to turn before the tap gets too great a strain. When this position is found a mark is scribed on the block so that the work can readily be placed in the correct position.

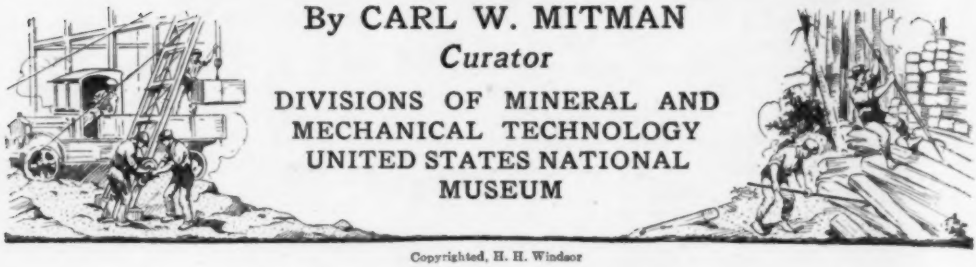


Left, Using Loose Block to Tap Small Work; Right, Details of Block

Drill-Press Clamp Bolts

Cheap and serviceable adjustable drill-press clamp bolts of the kind shown in the illustration can readily be made from suitable lengths of 1 by ½-in. iron. One end is cut down and threaded, while a series of holes to take a loose pin are drilled in line through the flat side as indicated. In use, the flat part is inserted into a slot of the drill-press table and the loose pin pushed through the hole that is nearest to the underside of the table. Then a nut is screwed in the threaded end to hold the work clamp.—John Harger, Honolulu, Hawaii.

MECHANICAL POWERS



By CARL W. MITMAN
Curator
DIVISIONS OF MINERAL AND MECHANICAL TECHNOLOGY
UNITED STATES NATIONAL MUSEUM

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FOR many months the National Museum in Washington has been designing and building an unusual set of models of remarkable interest. These illustrate most simply and clearly the fundamental principles of the various Mechanical Powers. These models show at a glance, what textbooks have heretofore taken pages to describe. This is the second of a series of articles by Curator Mitman—who is himself an engineer of great ability—which not only explain in simple language what every mechanic and inventor who designs or builds a machine must know, but also tell how any one can exactly duplicate for himself the complete identical set of models in the National Museum. Mr. Mitman tells how to do this with ordinary tools and at practically no expense for materials.

For schools teaching physics or manual training, the opportunity is now presented for the first time of duplicating the set of these models in the National Museum. If one or more classes each year will build a few of the models, which should bear the nameplate of the class, in the course of two or three years the school will possess not only lasting monuments to the classes, but acquire, without cost, the full set for use of all future students, and which can be available to all local mechanics and inventors for all time.

If schools desiring to take advantage of this opportunity will communicate with us, we will be glad to furnish suitable nameplates, bearing the name of the class and year, free. Address Room 408, Popular Mechanics Bldg., 200 E. Ontario St., Chicago.

This series will run for many months to come; the third article will appear in the May issue, and, as this is the first time articles like this have ever been published, they should be preserved for future reference.

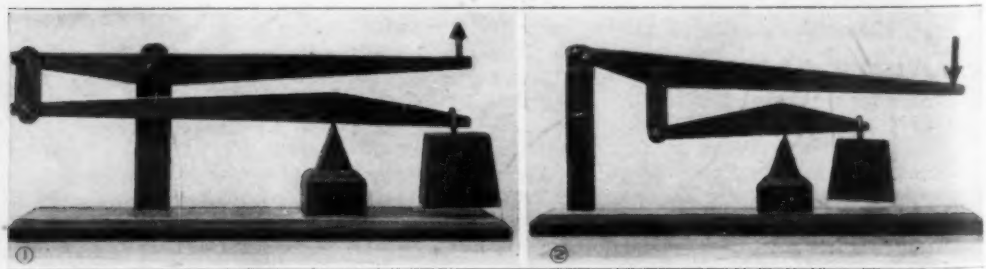


Photo No. 1, Completed Model of Compound Lever of the First Order; Photo No. 2, Model of Compound Lever Combining First and Second Orders

Part II—Moments and Compound Levers

A FORCE acting upon a lever tends to rotate it one way or another, depending first upon the magnitude of the force and second upon the perpendicular distance of the force from the fulcrum of the lever. These two factors taken together always determine the rotating or turning effect on the lever, and their product is called the moment of the force. In all questions involving levers and the work they are to do, the moments of the forces to be used must always be taken into consideration, and of greatest importance is the principle of moments. This states that when two or more forces act upon a lever and tend to rotate it about its fulcrum, then equilibrium will exist if the sum of the moments of the forces which tend to turn the lever in one direction equals the sum of the moments which tend to turn it in the opposite direction about the same axis. In other words, in the case of a first-order lever having two forces acting upon it on opposite sides of the fulcrum, as in Fig. 1, equilibrium will exist in the lever only when the moment of W (W times a) equals the moment of P (P times b). This is a very simple equation and is used to solve lever problems.

Should it be desirable, for instance, to know just how long a lever must be to accomplish a certain job or how much force must be applied to do that job with a lever of fixed length, the information is to be had by using the above equation. Fig. 2 illustrates just such a definite lever job, in that there is a force of 40

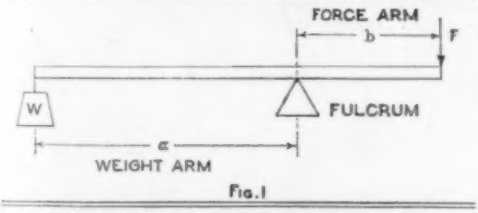


Fig. 1

Diagram Illustrating Principle of Moments

pounds available to bring into equilibrium three scattered forces acting on one arm of the lever and totaling 80 pounds pull. The question is, what length must the other arm of the lever be to permit the 40-pound pull to be effective. According to the principle of moments:

40 lb. × length of lever arm = 20 lb. × 40 in. + 50 lb. × 30 in. + 10 lb. × 25 in.

$$\text{Length of lever arm} = \frac{800+1{,}500+250}{40} = \frac{2{,}550}{40}$$

Length of lever arm = 63¾ in.

It will be noted that three calculations have been combined into one in this example; that is, instead of figuring the moment of the weight arms separately, a short cut was taken.

The principle of moments is the underlying principle not only of levers, but of the whole subject of the action of forces in general. It is applied by the bridge designer in determining the type of structure necessary to support all loads and under all conditions; by the architect in the de-

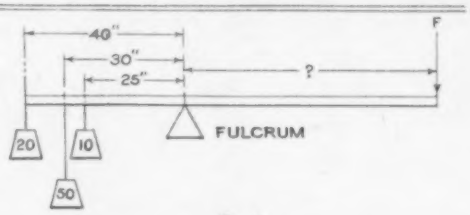


Fig. 2

Diagram Illustrating Problem in Design of Simple Lever

sign of buildings; and by the draftsman in the design of machines and machine parts.

When using levers to do work, and bearing in mind that the moments of the forces acting determine the effectiveness of the work done, it is quite easy to picture conditions in actual practice which would prevent the use of the simple order of lever, either due to the restricted space through which the applied force must act, the inconvenient location of the point of delivery of the power, or the prohibitive length of the lever arms. For such conditions combinations of the simple levers are used and these combinations are called compound levers. Of such mechanical powers there is an almost endless variety, beginning with combinations of two simple first-order levers; first and second-order combinations; first and third orders; two second orders; and so on. Then combinations of three, four and even five levers, some of which are first-order, others second and still others third-order. Thus the letter-printing action of one of the well-known typewriters is accomplished with a compound lever consisting of a second-order lever and two third-order levers. In the preceding chapter reference was made to that well-known saying, "What is gained in power is lost in speed." So, in the case of the typewriter action, speed is the object desired, but which must be produced with an available force of small magnitude (the fingers). The compound lever described above solves the problem.

Compound levers are sometimes rather difficult to recognize and even more difficult to devise for a specific piece of work

unless the individual parts of the combination can be distinguished. In this connection, therefore, attention is directed to Figs. 3 and 4, which illustrate two types of lever combinations, conventionalized for simplicity. Fig. 3 is a simplified drawing of a compound lever consisting of two first-order levers. That it is a combination of two first-order levers is recognized from the relative location of the applied force, the fulcrum, and the resisting force respectively, and it will be observed that the fulcrum in both the upper and lower levers lies between the two opposing forces, hence they are of the first-order, as brought out in the preceding article. The fulcrum in the upper lever in the model, Fig. 5, however, takes a different form from that of the lower. While this lever combination yields a mechanical advantage, it is gained at a loss of speed and distance through which the resisting force (weight) is moved. Even so, there are undoubtedly occasions in practice where this characteristic is the one desired. Probably the most extensive use of two first-order levers combined is in the hand brake of a wagon and the emergency brake of an automobile. Simply by substituting a longer link connecting the two levers, and a brake shoe or one end of a brake band for the weight, the diagram shown in Fig. 3 illustrates this mechanism. Again, the throttle control on certain American-type locomotives is gained by the aid of a compound lever consisting of two first-order levers.

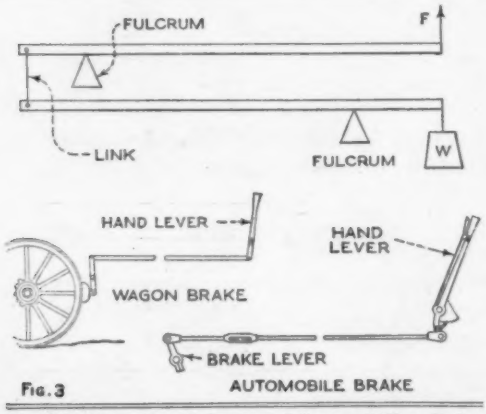


Fig. 3

Simplified Drawing of Compound Lever of First Order, with Examples of Its Use

Another type of compound lever is shown by the diagram in Fig. 4. This type is a combination of a second-order lever above and a first-order lever below. The combination is to be found in foot brakes both on wagons and automobiles, the difference between this type and type shown in Fig. 3 being the reversal of the position of the fulcrum and connecting link of the upper lever. This permits the applied force to be moved through a lesser distance to obtain the same work, and also in the opposite direction. Another application of this lever combination is found in some types of children's vehicles, especially those propelled by the child sitting on a platform and operating a vertical handle backward and forward.

For the compound-lever model, the first order, the following materials are required:

Base, 12-in. x 3-in. x ½-in.
Fulcrum block, 1½ in. square x ⅞ in.
Fulcrum, base ⅞-in. x ⅜-in., side 1-in. high.
Two lever arms, 11-in. long, ¼-in. wide, ¾-in. at apex.
Weight (resisting force), base 1¾-in. square, top 1¼-in. square, side 1½-in. high.
Pillar, 4½-in. x ⅞-in. x ½-in.
Arrow (applied force), 1¾-in. long, ¼-in. thick, ½-in. across barbs, ¼-in square shaft.

Square and face the base and block with a finish bevel on top of each. On the center line of the base, and 7 in. from the end, secure the block by gluing and bradding from beneath. On top of this glue and toenail the fulcrum with its longest dimension running parallel to the center line. 2¾ in. from the end of the base and 1 in. from its side, mortise a hole, ⅞ in. x ½ in., through the base. Connect the toe of one lever and the end of the other by the link, making the connection by drilling oversize holes in the ends of the levers and link, and inserting in these holes round-head brass screws. By a similar method pivot the lever on which the toe is linked to the pillar, by a hole drilled through the center of the lever at the apex, to accommodate a screw. Fasten the weight to the toe of the

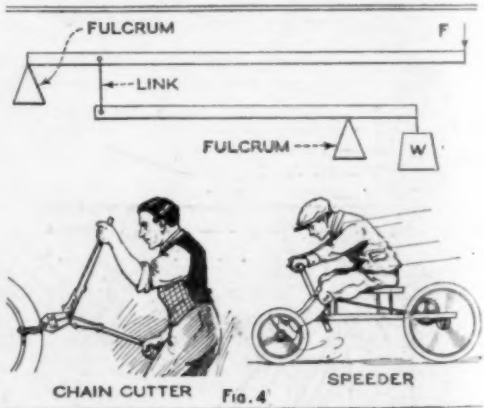


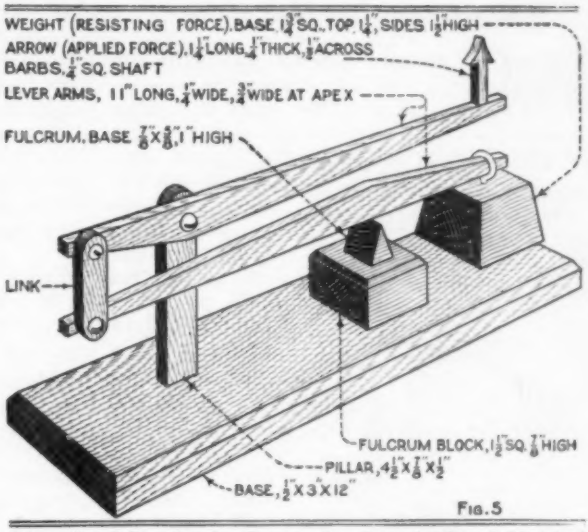
Fig. 4

Compound Lever of First and Second Orders, with Examples of Everyday Compound Levers

lower lever by inserting the screweye, used as a handle, in a notch cut in the end of the lever. Attach the arrow to the end of the upper lever by inserting the point in a notch cut therein. Fasten this assembly to the base by inserting the pillar in the mortise, securing with glue, and pivoting the lower lever on the fulcrum below the apex, retaining it by an invisible brad. Finish as desired.

For the compound-lever model, 1st. and 2nd. orders, use the following materials:

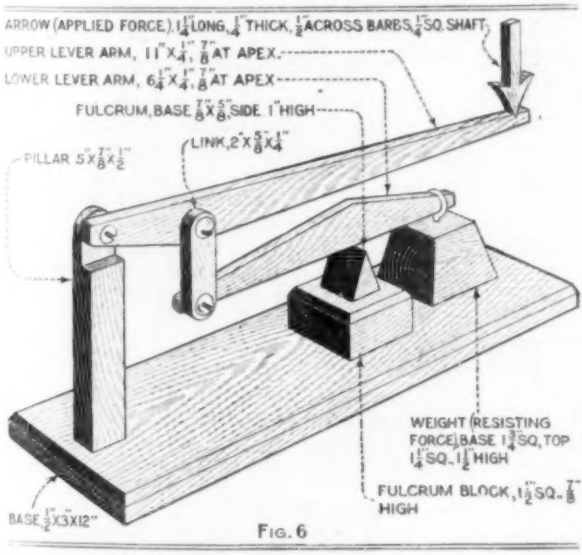
Base, 12-in. x 3-in. x ½-in.
Fulcrum block, 1½-in. square x ⅞-in.
Fulcrum, base ⅞-in. x ⅝-in., side 1-in. high.
Upper lever arm, 11-in. x ¼-in., ⅞-in. at apex.
Lower lever arm, 6¼-in. x ¼-in., ⅞-in. at apex.
Pillar, 5-in. x ⅞-in. x ½-in.
Link, 2-in. x ⅝-in. x ¼-in.
Weight (resisting force), base 1¾-in. square, top 1¼-in square, side 1½-in. high.
Arrow (applied force), 1¼-in. long, ¼-in. thick, ½-in. across barbs, ¼-in. square shaft.


WEIGHT (RESISTING FORCE), BASE 1¾" SQ., TOP 1¼" SQ., SIDES 1½" HIGH
ARROW (APPLIED FORCE), 1¼" LONG, ¼" THICK, ½" ACROSS BARBS, ¼" SQ. SHAFT
LEVER ARMS, 11" LONG, ¼" WIDE, ⅞" WIDE AT APEX
FULCRUM, BASE ⅞" X ⅝", 1" HIGH
LINK
FULCRUM BLOCK, 1½" SQ. ⅞" HIGH
PILLAR, 4½" X ⅞" X ½"
BASE, ½" X 3" X 12"
FIG. 5

Dimensioned Drawing for Constructing Reproduction of Model of First-Order Compound Lever

Square and face the base and block with a finish bevel on top of each. On the center line of the base and 6 in. from the end secure the block by gluing and bradding from beneath. On top of this glue and toenail the fulcrum with its longest dimension running parallel to the center line; ¾ in. from the same end of base and ⅞ in. from the side, chisel a mortise, ⅞ in. by ½ in. through the base. ¾ in. from one end of the pillar saw a cut across the width of the pillar ¼ in. deep, and remove the material from this cut to the nearest end. Insert the other end of the pillar into the mortise, gluing securely. Connect the apex of the upper lever and the end of the lower lever by the link, making the connection with screws inserted in holes bored in the ends of the link and the levers. Rest the screweye, used as a handle, in a notch cut in the toe of the lower lever. Fasten the arrow to the flat edge of the end of the upper lever by inserting the point in a notch cut therein. Fasten this lever assembly to the remainder of the model by pivoting the toe of the upper lever to the offset in the pillar with a screw and resting the lower lever on the fulcrum at a point under the apex, retaining it with an invisible brad. Finish as desired.

(Continued Next Month.)


ARROW (APPLIED FORCE), 1¼" LONG, ¼" THICK, ½" ACROSS BARBS, ¼" SQ. SHAFT
UPPER LEVER ARM, 11" X ¼", ⅞" AT APEX
LOWER LEVER ARM, 6¼" X ¼", ⅞" AT APEX
FULCRUM, BASE ⅞" X ⅝", SIDE 1" HIGH
LINK, 2" X ⅝" X ¼"
PILLAR 5" X ⅞" X ½"
WEIGHT (RESISTING FORCE), BASE 1¾" SQ., TOP 1¼" SQ., 1½" HIGH
FULCRUM BLOCK, 1½" SQ., ⅞" HIGH
BASE, ½" X 3" X 12"
FIG. 6

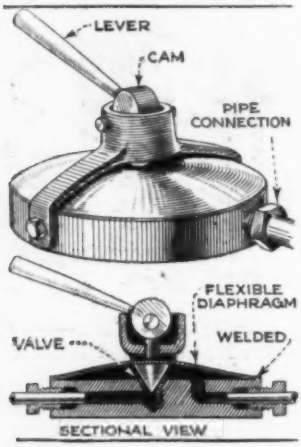
Full Details of Model of Compound Lever Combining Levers of the First and Second Orders

An Efficient Pen Cleaner

Most draftsmen and others using ruling or writing pens have the careless habit of allowing the ink to dry on the points. This soon accumulates and becomes very hard to remove. A good method of cleaning these pens is to allow them to stand immersed in a small bottle of common red writing ink for a few minutes. Even pens covered with a hard and crusted cake will look like new in a few minutes after being immersed.

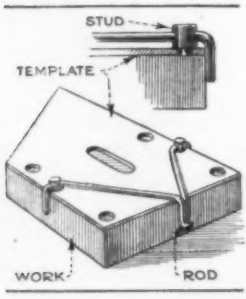
Novel Valve Has No Packing

Users of compressed air will find the valve shown in the illustration of considerable utility. It was developed in a large machine shop, to eliminate the trouble due to gland leaks in the usual valves, and found thoroughly practical. The valve body consists of a thick steel disk, drilled as indicated for the air passages, one of the passages being reamed to form a valve seat. A spring-steel diaphragm is dished and welded to the disk, and a conical valve welded to its center, as shown. A cast-iron yoke fits over the disk, and carries a cam fitted with a lever. The cam bears on the valve stem and forces it into its seat, and the spring of the diaphragm opens the valve again when the cam is released. This valve, of course, can be adapted to liquids as well as air.—G. A. Luers, Washington, D. C.



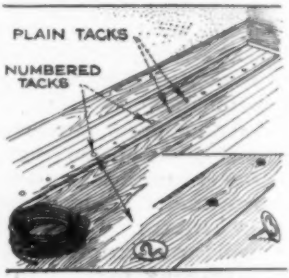
Attachment for Locating Template

Templates are usually the exact shape of the work they are used on and in many cases it is necessary to clamp them before marking off the job. If there are a number of pieces to be laid off, the locating and clamping of a template takes up considerable time. However, with the use of the clamp shown in the illustration the work can be greatly facilitated. Two studs, set on opposite sides, are riveted to the template as indicated and the heads are drilled to take a length of drill rod, which is doubled and bent to pass through the holes. In use, the template is placed on the work with the handle of the attachment in vertical position. The end of the template where the handle fits over should be slightly out of line, that is, showing the work beneath, so that the ends of the handle locate the sides when the handle is pressed down and the double part, which is bent slightly outward, pulls the template along until it is flush with the end. Locating is thus effected very quickly and the attachment grips the work securely enough to prevent any movement while the marking off is being done.



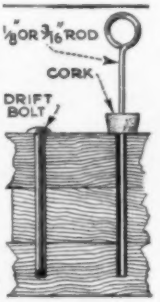
Measuring without Yardstick

In hardware stores where wire, rope, screen, and various other materials are constantly measured with yardsticks, the method shown in the illustration, which has already been adopted by a number of dry-goods stores, will be found to save considerable time. The scale is laid off on the edge of the bench top, or on the floor, brass tacks being driven in at 1-ft. intervals. If several yards are laid off in this way, numbered tacks can be used to designate the yards and ordinary brass-headed tacks for the foot intervals. This method of measuring is as accurate as any other and has the advantage of being much more convenient.



Gauge for Drift-Bolt Holes

Often in ship and bridge work and other heavy wood construction drift bolts are used for fastening. These bolts are without nuts and depend on friction alone for their holding power. When they are used for fastening two or more members together, they should never reach the bottom of the hole, and this makes it necessary to measure both the bolt and the hole accurately. The illustration shows a simple and convenient gauge for doing this. It consists of a length of wire, about No. 10 or 12, with a ring formed at one end, and a cork pushed on as shown. In use, the depth of the hole is measured by dropping



the wire down as far as it will go and then pushing the cork down until it touches the surface of the wood. The wire is then removed and a drift bolt selected that is a little shorter than the length indicated by the gauge.—J. A. Stevens, East Boothbay, Me.

Draftsman's Paper Cutter

Many T-squares and triangles are ruined by running a sharp knife or razor blade along the edge when cutting paper. This is a very careless practice and does not show good workmanship. It is much better to use a paper cutter of the kind shown in the photo.

This cutter was devised by a draftsman and found to facilitate the work considerably, without the danger of cutting into the T-square. It is made from two small pieces of sheet brass about $\frac{1}{16}$ in. thick, bent and soldered together as shown, with the lower edge of the vertical piece projecting about $\frac{1}{8}$ in. beyond the bottom piece to form a guide running on the edge of the T-square. The surplus solder is, of course, removed from the corner between the bottom piece and the projecting edge

Simple Paper Cutter for Draftsmen that Protects the T-Square

of the vertical piece, by means of a triangular file and all the edges and corners of the device are also filed down smooth. Two $\frac{1}{8}$-in. holes are drilled in the vertical piece at the points indicated, and are extended with a round file to form slots. The distance between these slots must be the same as the distance between the two holes in a safety-razor blade, which is then attached by means of small screws, $\frac{1}{2}$ in. long, fitted with thumbnuts. The blade can be adjusted to cut bristol board and drawing paper of various thicknesses, or even a number of layers of paper, and as it can be securely tightened to the holder, there is no danger of it breaking.

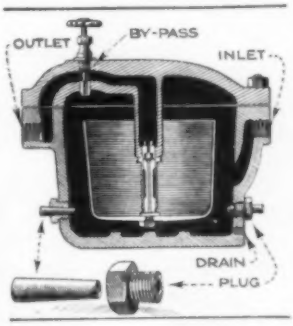
¶To tin brass and copper, boil the article with tin filings in a solution of caustic alkali or cream of tartar.

Tightening Tractor Belt

When using light tractors to fill a silo, or to run a thresher or any other farm machine, trouble often arises from the belt slackening. A simple method of preventing this is shown in the photograph. An automobile jack is set securely against a stone, or a stake driven into the ground, and it is then jacked up against the front axle of the tractor. If the tractor creeps, allowing the belt to slacken, it takes but a moment to jack it back enough to tighten the belt again.—J. C. Allen, West Lafayette, Indiana.

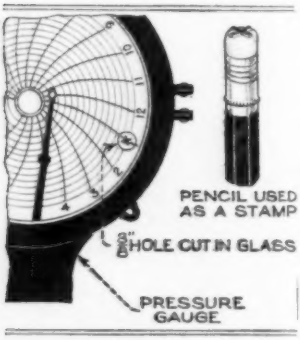
Preventing Damage to Steam Traps

In a heating system installed in a farm garage it was necessary to place a steam trap in a place where, at times, it was subject to frost, if neglected. This accident did occur a few times, and each time with the result that the outer shell, which was made of cast iron, was broken, making the purchase of a new one necessary. To prevent recurrence of this trouble two holes were drilled in the side of the case as shown and tapped for $\frac{3}{4}$-in cast-iron pipe plugs. A $\frac{3}{8}$-in. hole was drilled through each plug and a tapered steel pin driven in just tightly enough to withstand the ordinary pressure of the water inside. When the temperature became low the pins contracted more than the cast-iron plugs, and, if the water froze, the pins were pushed out without any damage to the case.—G. G. McVicker, North Bend, Nebraska.



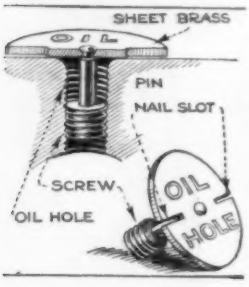
Recording Gauge Used as Watchman's Clock

In order to assure himself that the watchman of a large office building visited the boiler room at stated intervals, the superintendent made use of a pressure-recording gauge installed on the boiler, instead of purchasing a time clock. A ⅜-in. hole was drilled in the glass door of the gauge near its outer edge and on a line with the pen point. On each visit to the engine room the watchman inserts the inked rubber tip of his pencil through the hole in the glass and stamps a mark on the chart, thus indicating his presence in the engine room at that time. As the chart revolves a separate and distinct mark results at each visit, when the inked pencil rubber touches the chart. This device is "fool-proof" and the record cannot be faked unless the lock is opened. An ordinary stamp pad fastened to the side of the gauge enables the watchman to ink the rubber tip of the pencil. Simple individual marks are easily cut in the rubber tips.—John H. Schalek, Pittsburgh, Pa.



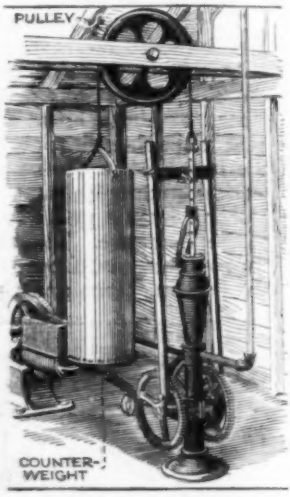
Oil-Hole Covers

Insufficient lubrication is the root of many machine troubles and a frequent cause of this is the general custom of furnishing machines with oil holes that are simply plugged with short headless screws, which often become entirely covered with dirt and grease so that they cannot be easily located. In order to make oil holes easily recognized, a pattern shop uses the covers shown in the illustration. Each consists of a circular piece of sheet brass with two short slots cut in it as shown, and a pin driven tightly in the center, the other end of the pin carrying a short screw which also fits tightly. Space is left between the cover and screw to allow it to be easily screwed down in the oil hole, which is tapped for this purpose. To place or remove the cover over the oil hole the finger nails are inserted in the slots. When stamped with plai nletters, this cover is easily noticeable, even in out-of-the-way places, and, being very thin, it does not foul working parts.



Counterweight for Pump

When pumping water from a deep well with a single-cylinder pump, the type mostly used, the upward stroke is very heavy as the whole column of water has to be raised, and the downward stroke is light. This uneven load causes a great deal of strain on the pump jack and engine and therefore the counterweight, shown in the illustration, was adopted. The size of the weight needed was found by turning the pump-jack pulley by hand and adding weights until the load was uniform, that is, when the downward stroke and upward stroke were equal. The counterweight used was an old hot-water tank, about 4 ft. long, partly filled with stones. It was suspended from a ¼-in. steel cable, run over a 14-in. pulley and tied to the top end of the plunger rod of the pump. It was found that, due to this arrangement, an engine of less power could be used to do the same work.



However, as this engine was too small to do the work without a counterweight, a handle was attached to the latter, so that it could be made inoperative until enough water was raised in the well to counterbalance the weight. This is only necessary, of course, when an underpowered engine is used.—Jonas Byberg, Silverton, Ore.

¶Two parts of tallow and one part of neat's-foot oil, melted together, make a good belt dressing. Apply once a month with a brush.

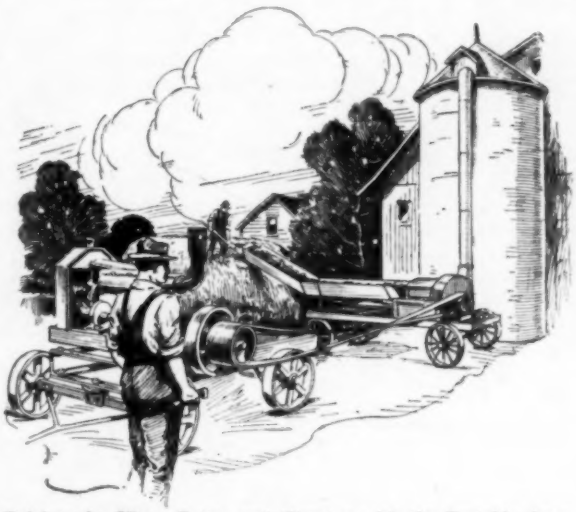
Portable Power Plant for Farm

By J. V. ROMIG

Just as this article was being prepared for publication, we learned, with deep regret, of the death of Mr. Romig at his home in Allentown, Pa. Mr. Romig was one of our earliest and best contributors, and, through a long and friendly relationship, we had come to respect sincerely his ability as a mechanic, designer, and writer, so it is with a sense of real loss that we pen this brief tribute. His articles found many admirers among our readers, but for these friends of his and ours there is a measure of consolation, in that we have a number of his articles still unpublished; his constructive work will, therefore, not cease immediately.—Editor.

MANY old automobiles, the engines of which are in good and serviceable condition, are scrapped and broken up each year by junk dealers. Such an engine is good for many more years of stationary use, and would form the basis of an ideal portable power plant for the farm. Before purchasing any portable or stationary power plant, the prospective user should give the auto plant careful consideration.

The first cost is small, as these engines can be purchased as low as $20, depending upon their condition. Any power, and any speed within their range can readily be secured, and governors can be fitted to them readily and cheaply, to hold them to any speed desired. These governors usually operate on the gasoline feed, controlling the opening and closing of the throttle in the intake manifold.



Driving the Silage Cutter and Elevator with the Portable Auto-Engine Power Plant

The best engine to select for a portable power plant is a four-cylinder water-cooled plant, of about 18 to 20 hp., with magneto ignition, and pump-operated water circulation. An engine with mechanical oilers should be shunned, as these are out of date, and a motor with a good constant-level splash lubrication is to be preferred, for this purpose, to one having a full force-feed system. If possible, the engine should be examined thoroughly before purchasing, to determine if the cylinders are scored or scratched; such a motor should not be bought, even though the cylinders can be reground, as regrinding is an expensive job. The water jacket should be examined for cracks and leaks, and, if any are found, the engine should be rejected. Loose pistons should also be a cause for rejection, but if only the rings are worn, this is not important, as they can easily be renewed. Loose bearings can also be remedied easily, and, if the engine is good otherwise, may be overlooked.

Magneto ignition is very desirable, as it is a self-contained system. If the engine is of the magneto-ignition type, the starter and generator may be removed. If of the battery ignition type, discard the starting motor, but retain the generator.

To be portable, the engine must be mounted on a truck of some sort, and, while a suitable truck can be bought comparatively cheap, the writer advises that only the wheels and axles be purchased, and that the frame of the truck be built up of 5-in. channel iron, as shown in the illustration. The mounting of the engine on the frame need not be a very hard job, if the builder has a few hints to guide him in the construction.

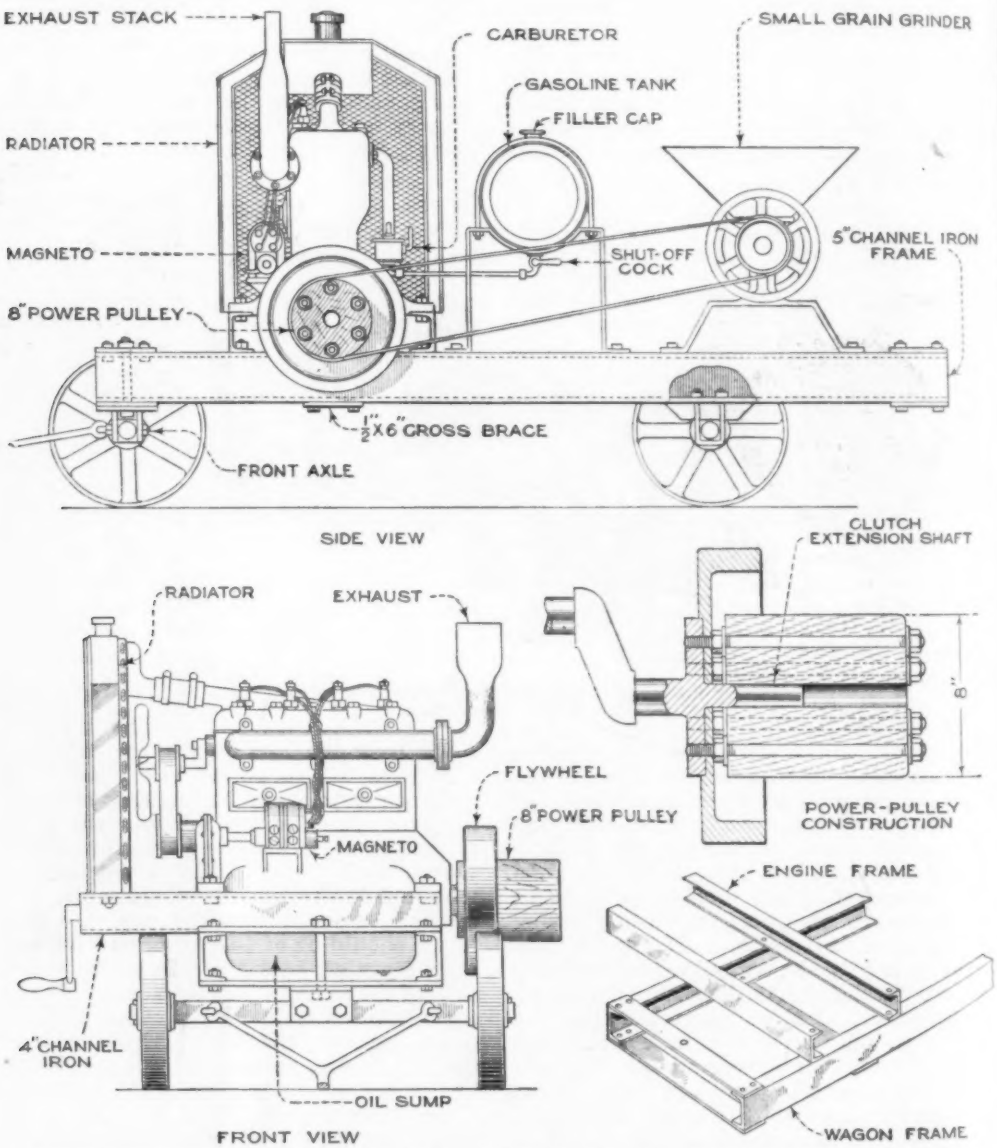
Engines are supported in car frames in different ways, some having four supporting arms, like the unit shown, others but three, two at the rear, and a yoke or round journal at the front. In any event, a cross-mounted sub-frame will be found the best method of supporting the engine. This frame should be of 4-in. channel iron, and should project over the side of the truck, so that the radiator can be mounted in the same position as in the car. A crosspiece of the same material should tie the ends of the sub-frame, to support the cranking-handle bearing, and to stiffen the assembly. Cross-braces, made of ½ by 6-in stock, should be used wherever necessary, and be fastened in place by capscrews. It is

recommended that the radiator used be one taken from a larger car than that from which the engine was obtained, or from a heavy truck, to provide the additional cooling capacity necessary for long runs under full load.

The drive pulley for general purposes can be built up of wood, bored out to fit over the clutch extension shaft, and fastened to the flywheel by means of long studs, screwed in place of the regular flywheel capscrews. This makes a strong and rigid driving pulley; for higher speeds, the flywheel itself can be used as a pulley.

The gasoline tank should be a large one, of 15 to 20-gal. capacity, and should be mounted on flat-steel brackets high enough to provide a gravity feed to the carburetor. Care should be taken to obtain a tight tank, with well-soldered connections. A shut-off cock should be fitted between tank and carburetor.

The treatment of the exhaust is simple. A thin pipe section is bent and flattened, as shown in the drawing, then coupled to the end of the exhaust manifold by means of



General Arrangement of Portable Gasoline-Engine Plant for the Farm, Showing Details of Frame, Sub-Frame, Drive Pulley, and Method of Mounting Engine

thin flanges, or a threaded coupling. The flat opening should be about ¼ in. wide; this will minimize the sound of the exhaust to some extent, while permitting free escape of the gases.

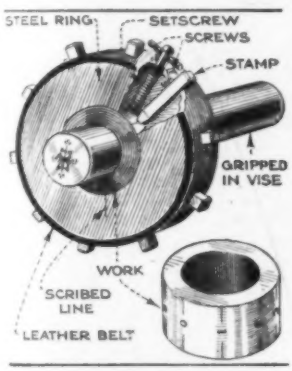
As large a fan as possible should be fitted, and the belt kept tight at all times. Use none but clean water in the radiator, and only the best grade of oil in the engine.

Besides driving the threshing machine, grain elevator, and other farm implements, the frame may be made to accommodate a small machine, as suggested in the illustration. Such machines as a water pump, sprayer, or an air compressor may readily be mounted on the frame. The length of the frame will, of course, depend on the machine that is to be mounted on it.

A power plant of this type will prove of considerable value on any large farm, as instead of trying to connect the machine to a stationary engine by long pipes or belts, the portable plant may be driven right up to the job.

Stamping Graduated Collars

In a small shop having a number of graduated collars to stamp from 0 to 9, it was found that the usual method of stamping each number separately was too slow, and that a quicker method would have to be adopted to make the operation profitable. A fixture that was found to facilitate the work considerably is shown in the illustration. It consists of a steel ring that fits over the collars, having ten holes drilled through from the outside, these being equal in diameter to the corner-to-corner dimensions of the stamps. To hold the stamps squarely in the holes and to prevent them from falling out, the ring is covered with a piece of 1-in. belt, fastened with a couple of screws, and square holes are cut in the belt to fit tightly over the stamps. A hole is drilled and tapped for a tightening screw, with which the fixture is tightened on the collar. After the collar is slipped on a short length of steel rod, which is held in the vise, the ring is turned so that the numerals on the stamps are brought in line with a mark already scribed on the collar and they are then impressed by tapping lightly with a hammer.



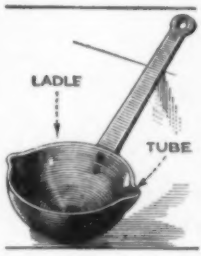
A 30 by 3½-in. clincher rim sometimes causes the casing to pinch the tube. This can be prevented by cutting from a scrap tube a strip of rubber, 1½ in. wide, and running this strip around the rim. One hole is cut at each end of the strip for the valve. An oversize tube should also be used.

Filing Crosscut Saws

Large crosscut saws used for sawing logs are, owing to their size, difficult to file when sharpening them without the aid of a vise. Experienced woodsmen employ the slot-and-wedge method of holding the saw, as shown in the drawing. A deep slot is cut across a log or heavy timber and the saw is placed upside down in this cut. One or two small wooden wedges are then driven in the cut to hold the saw securely in position and it can then be filed readily. —G. E. Hendrickson, Argyle, Wis.

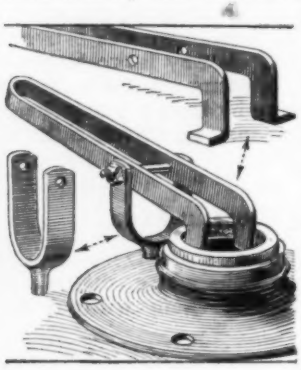
Improving the Ladle

When pouring a large number of small lead castings the writer was seriously handicapped by the necessity of frequently removing the dross from the surface of the molten lead, in order to obtain clean castings. After some experiments the method shown in the illustration was found to eliminate this trouble entirely. A short length of steel tubing was welded to the inside of the bowl of the ladle, from the center of the bottom to the lip, as indicated, so that the metal would be taken from the bottom where it was free from dross. It was then no longer necessary to skim the metal at all, and the work could be accomplished with much greater speed. —R. H. Kasper, Philadelphia, Pa.



Removing Dust Caps from Hubs

Sometimes it is necessary to remove the dust cap from a front wheel of a Ford automobile, and this is usually done by tapping the cap out of the hub with a hammer and punch. This method is objectionable, however, as it often results in damaging the cap. The tool shown in the illustration has been found very practical for this job. It consists of a length of flat steel, 1 in. wide and ¼ in. thick, bent to the shape shown and pivoted on a yoke made of the same stock. A short length of round-steel rod is welded to the bottom of the yoke to fit in one of the bolt holes of the hub flange. In use the frame of the tool is pressed together to allow the ends to be inserted under the cap, and pressure is then applied on the doubled end; this draws the dust cap out without damage.—R. M. Thomas, Denver, Colorado.



Two Kinks for Draftsmen

In making record drawings from customers' patterns it is sometimes necessary to know the contour of a groove. Of course, a paper template can be made by the "cut-and-try" method, but a quicker way is to light a candle and let the drippings build up in the groove as shown in Fig. 1. This is removed and cut with a knife so as to form a section at right angles to the groove if it is straight, or radial if it is circular. The cut face can then be laid on the drafting paper and the contour traced off direct.

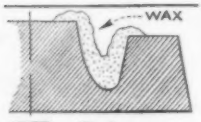


Fig. 1

In a manganese-steel foundry drafting room where it is often necessary to obtain the actual length of a shrink-rule dimension, the T-squares are ruled as shown in Fig. 2 of the drawing. A centerline is first drawn and on one side a standard 2-ft. scale is laid off by eighths of an inch. On the other side of the centerline, a shrinkage scale is laid off. This makes a convenient reference in determining the actual lengths of pattern dimensions. For example, if it is desired to know the proper length of a soft-steel insert that is to be cast in the manganese steel for convenience in machining, the distance between the ends of the prints on the pattern is noted on the shrink scale and then the correct length to cut the soft-steel insert, so that it will fit in the mold snugly, may be obtained by reading the standard scale at the point noted.—D. A. Price, Chicago Heights, Ill.

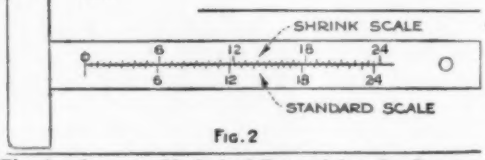
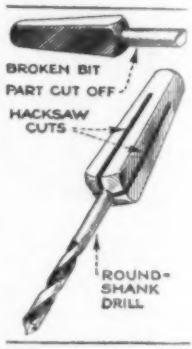


Fig. 2

Fig. 1: Accurate Method of Determining the Contour of a Groove. Fig. 2: A Standard Scale and a Shrink Scale Ruled on T-Square for Convenience

Brace Chuck for Round-Shank Drills

When small bits are used in an ordinary brace they are frequently broken. The shanks, however, should not be thrown away. Saw off the broken stem as shown in the illustration and slit it lengthwise with a hacksaw as shown, thereby dividing the shank into four pieces, save for a narrow strip at the small end. A small round-shank drill is inserted in the shank, which is then clamped tightly in the brace chuck. For larger sizes of round-shank drills, it is, of course, necessary to enlarge the hole in the shank, which may be done by filing or chipping off the four inside corners, which grip the drill. Another way is to place two hacksaws side by side in the saw handle and split the shank with two saws instead of one, or for fairly large drills, to drill a hole in the shank before slitting.—James F. Hobart, Dunedin, Fla.



When painting a wire wheel it often happens that the valve stem is daubed, which makes it difficult to remove the valve nut after the paint is dry. To remove the valve nut, cut it with a chisel, or soak the stem in gasoline and light it to burn the paint off. It is usually necessary to repeat the latter operation a few times before the paint softens.

Raw Oil as Stain

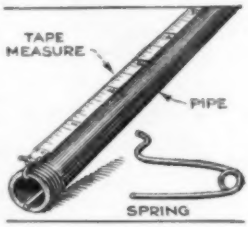
While turning out a number of mahogany cabinets on a rush order the supply of mahogany stain became exhausted. As it would mean a considerable delay to have the order held up until more could be obtained, raw linseed oil was tried out as a substitute and the results obtained were highly satisfactory. It was rubbed into the wood until the desired shade was obtained and then rubbed down with a dry cloth. Coats of shellac were next applied and rubbed down, and the surface finished with a final rub-down of pumice and oil. —T. W. Bean, San Pedro, Calif.

Improving Torch Air Pump

Nearly every mechanic has experienced the annoyance caused by the leather washer on the air-pump plunger of a gasoline torch drying out, especially after the torch has not been used for a long time. A good method of eliminating this trouble is shown in the illustration. A groove is turned in the side of the piston for a single turn of a coil spring to fit in, the groove being just deep enough to allow the springs to project about .01 in. above the surface. The coil spring, which must be of slightly smaller diameter than the piston, will fit tightly in the groove, holding the leather skirt in place, and preventing any trouble even though the torch is not used for several months.

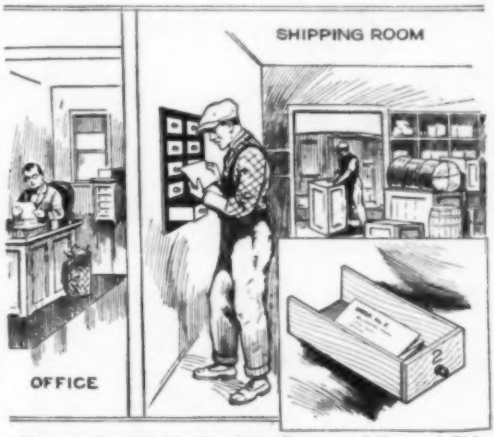
Measuring Pipe with Tape

Pipe workers will appreciate the spring shown in the illustration as it greatly facilitates measuring long lengths of pipe, when the work is done by one man. A length of spring wire is bent to the shape shown, and is inserted in the end of the pipe so that the tape measure can be hooked onto it. The spring should be sufficiently strong to take care of pipe ranging from ½ in. to 1 in. in size.



Backless Drawers Aid in Office

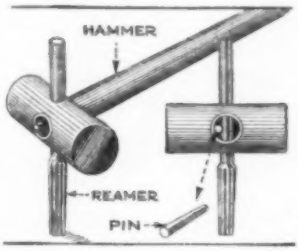
In a small establishment, where the office was located next to the shipping room, the drivers were in the habit of coming in constantly to get orders, and this was more or less disturbing to the office force. To prevent this annoyance, a number of small drawers were fitted in the partition between the office and shipping room, for the purpose of holding the orders in readiness for the drivers. The drawers were made of wood, and had no backs, so that the orders could be quickly inserted in them from the office side. A separate drawer was provided for each driver and this eliminated waste of time on the drivers' part in sorting the orders.



Drawers Installed in Partition Between Office and Shipping Room Found to Save Considerable Time

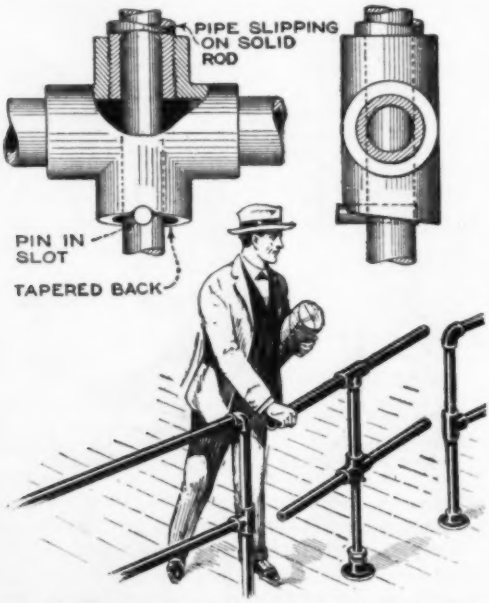
Hammer Used as Reamer Wrench

It is often possible to combine tools used constantly, to save time in handling them separately. The photo shows a combination tool consisting of a hammer and reamer. The hammer is an all-metal one with a hole drilled through the head for a reamer, which is driven in. The shank of the reamer is ground flat so that a pin, driven in, holds it snugly and keeps it from turning. The tool was found to be a time saver, as it was first used to ream out holes for pins, which were then tapped in with the hammer.



A Self-Closing Rail Gate

Part of the contents of a warehouse were considered dangerous enough to be railed off, and in constructing the rail a novel gate was built in the center of it. With



A Self-Closing Gate that Can Be Made from Lengths of Pipe and Fittings

the exception of one part, the gate is made up of iron pipe and fittings the same as the rail. In the center of the space left for the gate a piece of solid, round stock, with a pin driven in, is fixed vertically by screwing one end into a floor flange and screwing the latter to the floor. The gate proper is made from lengths of pipe, a cross and a tee. The vertical lengths of pipe between the fittings slide over the solid rod, as shown in the left-hand detail. A shallow slot is cut in the bottom of the cross to fit the pin driven through the rod. The edges of the slot are filed round, as shown in the detail, so that the gate can readily be pushed open without interference from the pin. The bottom edge of the cross is beveled toward the slot, as shown in the right-hand detail, so that the gate automatically turns to the closed position when released.

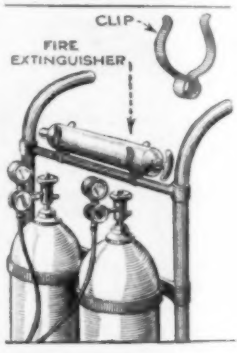
¶Screeching auto brakes are usually caused by particles of dirt and mud between the lining and the drum. Wash these out when washing the car, and the screeching will stop. The water also helps the lining.

Using Soap on Concrete Forms

Crude oil is usually applied to forms in concrete construction work to prevent the concrete from adhering to the wood. However, there is a disadvantage in using oil for this purpose if a finishing coat is to be applied later, as a thin film of oil will be left on the surface of the concrete and this prevents it from bonding properly with the finishing coat. Soap dissolved in water will serve the same purpose as the crude oil without the undesirable effect just mentioned. The soap solution should have the consistency of thin paste, and it can be applied hot by means of a whitewash brush or a broom. As soap is easily dissolved, even by cold water, the film can be washed away by means of a hose in a short time, leaving the concrete clean.

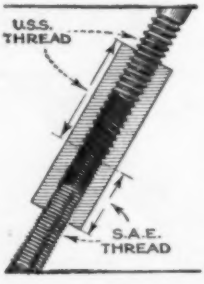
Fire-Extinguisher Mounted on Truck

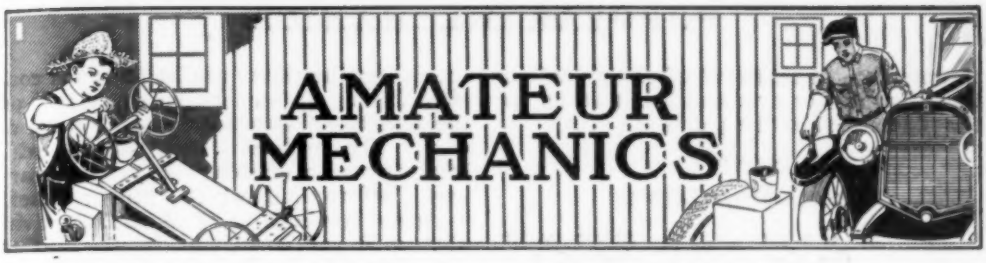
A large automobile manufacturing concern doing a considerable amount of welding has provided a fire extinguisher on every truck carrying the welding equipment. A pair of heavy spring clips are attached to the crossbar of the truck near the handles to hold the extinguisher, which is of the hand-operated type, so that in case of fire it is within reach of the workmen.



A Novel Turnbuckle

Turnbuckles are usually tapped for a right and a left-hand screw, but a good one can easily be made that is tapped for two right-hand screws, having different-size threads. About three-fifths of the body of the turnbuckle is tapped with a U. S. S.-thread tap; the rest with a S. A. E.-thread tap. Due to the greater pitch of the U. S. S. thread, when the body of the turnbuckle is turned, the screw with this thread travels nearly twice as fast as the other screw.





The "Lame Duck"

By LOWELL R. BUTCHER

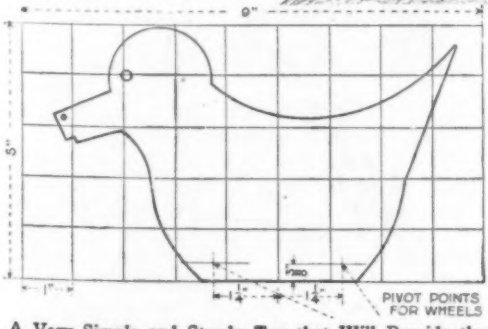
THE "lame duck" is a toy that will delight the heart of any child. When pulled across the floor by the lead string, the duck will do a number of amusing things. It will wobble back and forth, sidewise, and will sometimes combine the two movements at the same time. By placing the four wheels that support the toy off center, a number of surprising actions are made possible.

The body of the toy is made of 2-in. material; 1-in. finished lumber may be used instead, but the 2-in. thickness will place the wheels farther apart, and there is less danger of upsetting the finished toy. Unless several of the toys are desired, in which case it is best to cut out a cardboard pattern, the body can be laid out directly on the board chosen for that purpose.

The toy shown in the photograph was made from a block of wood 5 in. wide, 9 in. long and approximately 2 in. thick. By marking the block off into 1-in. squares, as shown in the diagram, the shape of the duck can easily be sketched in by referring to the illustration. A scroll or keyhole saw is best for sawing out the body shape.

Four wheels of ½-in. material are sawed

or turned to an outside diameter of 1½ in. The holes for the wood screws that fasten the wheels to the body are drilled ¼ in. from the center of the wheels. The location of the pivot points of the wheels on the body is shown in the diagram. Naturally, the holes through the wheels should be slightly larger in diameter than the screws to be used.



A Very Simple and Sturdy Toy that Will Provide the Growing Youngster with Endless Amusement

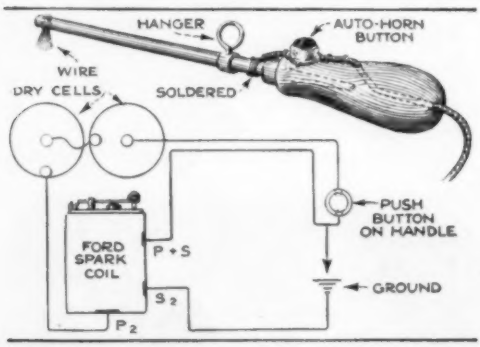
In assembling the toy, a thin washer should be placed between the body and each of the wheels. Likewise, a washer should be placed between the wheel and the screw head to prevent needless friction.

A very small hole drilled in the bill of the duck allows a lead string to be attached. If the toy is painted with some care, and the eyes, wings, tail feathers, etc., made darker than the remainder, the resemblance will be better. The completed toy is sturdy, with no complicated mechanism

to go wrong, and the "rollicking" action given by the eccentric wheels is amusing to the old as well as the young.

Electric Stove Lighter

Lighting the gas or oil stove with matches is the time-honored method, but the use of an electric spark to do this has



Simple Electric Gas-Stove Lighter Using an Induction Coil Can Be Made by Any Boy

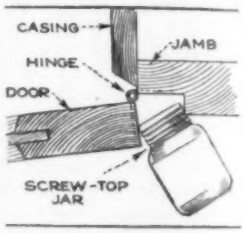
been found much more convenient and economical. The device for producing the spark can be assembled by any boy who is interested in electricity. It consists of two or three dry cells, a Ford induction coil, and a wire brush made from an old fly swatter, fitted with a thick wooden handle. These parts are connected up as shown in the diagram, the high-tension side of the induction coil, indicated by S_2, being securely grounded on the stove. A hanger is provided on the wall for the wire brush, which, when not in use, must be held away from the stove so that there can be no contact between the two. A small automobile push-button horn of the kind used on the steering column is mounted on the handle, as shown, to control the primary circuit. In use, the gas is first turned on, the push button pressed down, and the brush brought in contact with the gas plate. A series of hot sparks will jump from the brush to the plate and will ignite the gas immediately.—Ed. S. Allen, Troutdale, Ore.

Alcohol Used in Patching Tube

After immersing part of an inner tube in water to determine the exact spot of a puncture, it takes a long time before the tube is dry again and ready for the patch, it being absolutely essential to have the surface perfectly dry to secure a good adhesion. It has been found that the evaporation of the water can be hastened considerably by an application of alcohol on the punctured area with a small piece of cloth. The surface is then roughed with sandpaper or a scratcher in the customary way. Before applying the rubber cement a second application of alcohol is advisable, as it will clean and dry the surface immediately.—G. A. Luers, Washington, District of Columbia.

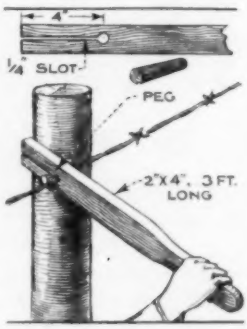
Opening Screw-Top Jars

When it is impossible to remove the screw cap of a jar by hand, the job can usually be accomplished very easily by inserting the cap between the edge of the door and the door jamb as shown in the illustration. This holds it tightly while force is applied to turn the jar. The foot is placed behind the door to press it against the jar. Too much pressure will, of course, break the jar or distort the cap.



Homemade Barbed-Wire Stretcher

After trying various kinds of barbed-wire stretchers, none of which proved satisfactory, the stretcher shown in the illustration was constructed and gave excellent results. It was made from a piece of 2 by 4-in. material, about 3 ft. long. One end was slightly rounded to serve as a handle and a ⅝-in. hole was drilled about 4 in. from the other end. A ¼-in. slot was then cut from the end to this hole to slip over the wire. After the wire is located in the hole, as shown, a round tapered wooden peg is pushed in to keep it there. Then, using the post as a fulcrum, the wire is pulled tight by drawing the stretcher up against one of the barbs. The peg should project far enough on each side of the hole so that it can readily be driven in or out with a slight tap of the hammer.—G. W. Adams, Haughton, La.

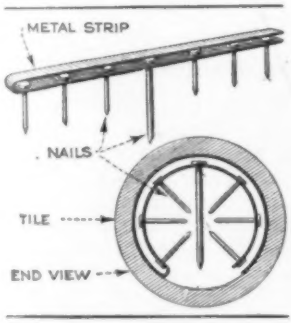


Pruning Apple Trees

For a number of years fruit growers have debated the comparative value of high and low heading of trees, and the heavy and light-pruning methods. In experiments conducted over a period of ten years by orchard horticulturists at the New York experimental station, with several standard varieties of apple trees, it has been found that with the trees all headed about 2 ft. above the ground when set out in the orchard very little pruning will produce a tree that will keep its shape and symmetry, and have greater bearing area than a tree that has been pruned considerably. The root systems of low-headed trees become more firmly established in the soil, and thus offer greater resistance to the wind than the high-headed trees.—E. R. Haan, Chicago, Ill.

Easily Made Screen for Drain Tile

After excavating more than 100 ft. of drainage tile to locate an obstruction that had clogged the entire system, and delayed plowing of an adjoining field, the cause of the trouble was found to be a dead rabbit, which, according to appearances, had been wounded by hunters and had crept into the drain to die. Other cases are also known where dead rabbits, woodchucks, muskrats, and other animals have caused the same trouble. A simple screen that will prevent this, and save the considerable expense of digging the drain open, is shown in the illustration. It consists merely of a few heavy nails or spikes and a 2-ft. length of steel barrel hoop. The strip of steel is perforated and the nails driven through as shown, then the strip is doubled over. The screen is bent to the shape of a horseshoe of smaller diameter than the diameter of the tile, and placed in the tile mouth. The spring of the steel strip will cause it to expand against the tile. Such a screen affords a good protection.



¶Mothballs distributed in the runway of moles are effective in driving them away.

Facilitating Handling of Rowboats

Ordinarily it requires the efforts of two men to launch a rowboat, but one man can easily do the work if the rowboat is provided with a small bronze roller as shown in the drawing. The detail shows how such a roller is attached; a wooden skeg keel is fastened to the main keel at the stern by means of iron plates and lag-screws, and a recess is cut in the skeg to accommodate the roller, which is held in place by means of two bronze side plates. The roller must, of course, turn freely between these plates. A steel or iron roller should not be used, as it soon rusts and then becomes useless. The roller should be kept well greased in order to obtain the best results.—J. E. Hoag, Los Angeles, California.

Small Bronze Roller Attached to Skeg Keel on Rowboat Enables One Man to Launch It

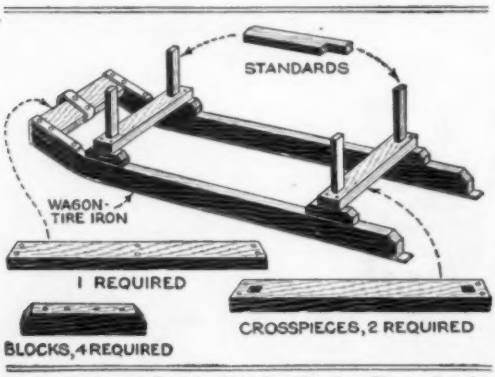
Powder Gun for Fuller's Earth

Fuller's earth is of great utility to the car owner for drying fan belts, clutches, brakes, etc., and for numerous other purposes around the house and garage. A convenient holder for this powder is a small insect gun, which can be purchased from almost any drug store for a few cents. With this gun the powder can be applied evenly and without wasting it, in places that cannot easily be reached otherwise. Talcum powder or mica dust, used when repairing inner tubes and tires, may also be applied in the same way.

Sturdy Skid for the Farm

One of the most useful things on a farm is a skid that can be used for hauling heavy loads. Such a skid, which is very durable, due to its sturdy construction, and is also convenient, as the things to be moved need not be lifted high when loading, is shown in the illustration.

The runners are 8 or 9 ft. in length and



Easily Built and Sturdy Skid for Hauling Heavy Loads over Mud and Snow

are cut from logs that have a natural crook at one end. They must, of course, be of the same length and should preferably be of the same kind of wood. The edges are trimmed down with an ax to a uniform width and the top is also flattened where the crosspieces are to be attached. These are simply pieces of good strong plank, about 3 in. thick, 8 or 10 in. wide, and 4 ft. long. They are not fastened directly to the runners but to small 3 by 18-in. blocks, which are attached to both the runners and crosspieces by means of ⅝-in. bolts. The bolts are put in from the underside of both runners and blocks and in both cases the holes are countersunk to take the bolt heads. The rear crosspiece should be located about 20 in. from the rear end of the runners, and the front one just behind the crook. A third crosspiece is bolted to the front end of the runners as shown, a recess being cut in the runners so that the surface of the crosspiece comes flush, and it is made doubly secure, so that it will stand any strain in pulling, by running a length of wagon-tire iron over it as shown, and then running it along the underside of the entire length of the runner. Heavy flat-head wood screws are used to attach the iron strips to the runners, holes being drilled and countersunk for the screw heads.

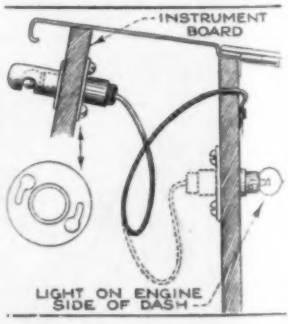
It is advisable to provide short standards on the crosspieces to keep the load in place. The ends of the standards are cut down to fit into square holes cut in the crosspieces. A clevis is also provided in the center of the front crosspiece.—J. R. Koontz, Bremen, Ind.

Correcting Distorted Building Photos

Unless provided with an adjustable front an ordinary camera cannot be used to photograph very high objects without tilting it to include the top of the object, and this produces a picture that is out of proportion, the walls appearing to converge near the top. To produce a normal picture from such a distorted photograph, print the negative through an enlarger, tilting the easel on which the printing paper is fastened at an angle to the negative. This will bring the object back to its normal proportions. This method has an advantage over the old of taking the picture with the camera level at a more distant location, which is not always desirable, as the whole object will then be much smaller. Tilting a camera is therefore entirely justifiable as a good method of photography, provided, of course, that the angle is reversed when printing through an enlarger.

Double-Purpose Dash Lamp

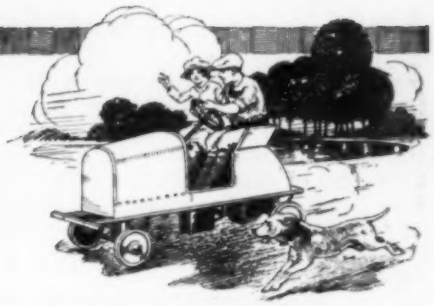
The dash light on an automobile is usually permanently mounted on the instrument board; the one shown in the illustration, however, can be quickly removed and attached to the dash, to provide light on the engine side, whenever necessary. The screw holes in the flange of the fixture are enlarged to clear the screw heads, and slotted as shown, to enable it to be detached by giving it part of a turn. The screws in the instrument board and dash are, of course, stationary. The cord used is long enough to permit the lamp to be shifted readily from one position to another.



This improvised engine light is handy very often, especially in the absence of a regular trouble light. By removing the small cap, a good light is obtained.

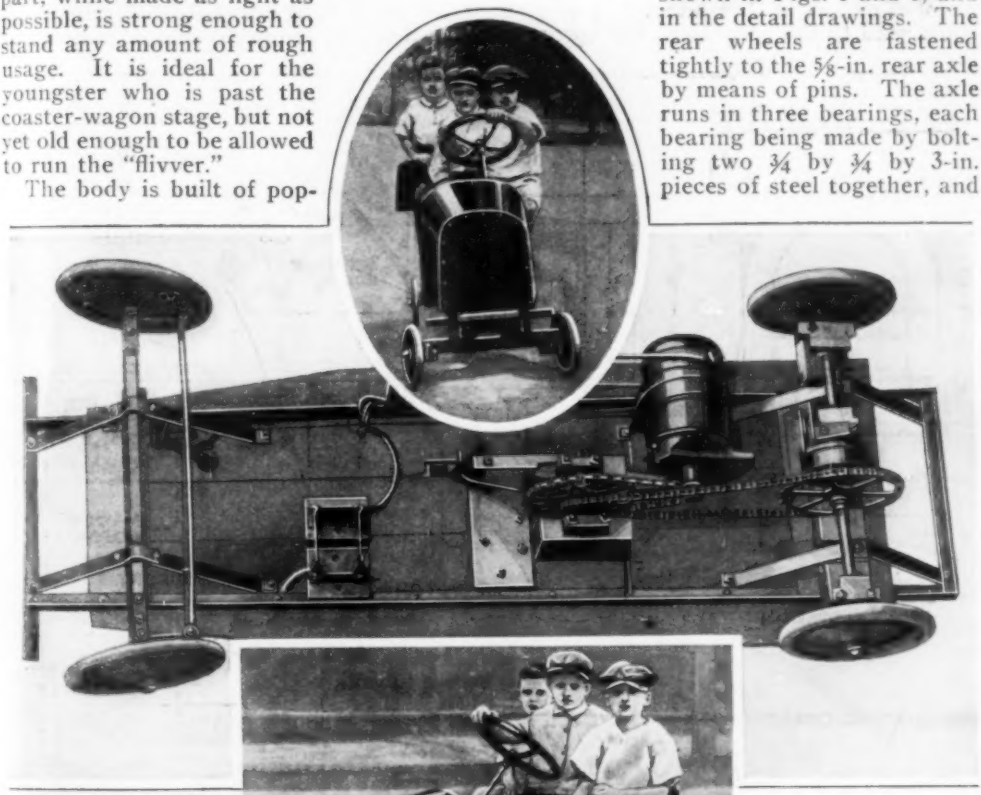
MAKING A SMALL ELECTRIC AUTOMOBILE

By E. B. Stack



THE electric automobile described in this article is not merely a toy, but a real electric car. It was designed and made for children, but will carry a load of four hundred pounds with ease. Every part, while made as light as possible, is strong enough to stand any amount of rough usage. It is ideal for the youngster who is past the coaster-wagon stage, but not yet old enough to be allowed to run the "flivver."

The body is built of popular, with a streamline hood, and is supported by a steel chassis. The angles for the chassis were obtained from a discarded iron bed, and the bumpers were made of the same material. Steel disk wheels, about 10 in. in diameter are used, fitted with 1-in. rubber tires; these can be obtained from many supply houses, or taken from a coaster wagon. The two front wheels are ball-bearing, mounted in the same manner as in an automobile, as shown in Figs. 1 and 3, and in the detail drawings. The rear wheels are fastened tightly to the 5/8-in. rear axle by means of pins. The axle runs in three bearings, each bearing being made by bolting two 3/4 by 3/4 by 3-in. pieces of steel together, and drilling the bearing hole across the joint, thus leaving half of the bearing in each piece. The bearing bolts pass through a poplar crosspiece bolted to the chassis of the car. Tin covers are made and screwed over each of the bearings; these are



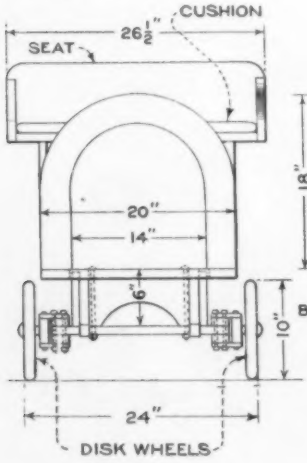
Above, Front View of Car; Center, View of Underside, Showing Transmission, Brake, Etc.; Below, Side of Car, Showing Location of Switch and Motor

packed with oil-soaked waste, to lubricate the bearings. A small pulley, about 4 in. in diameter, is setscrewed to the center of the shaft, to act as a brake drum, and a thin piece of sheet steel, faced with regular brake lining, used as a brake. The method of mounting this and the connections to the brake pedal are clearly shown in the detail drawing.

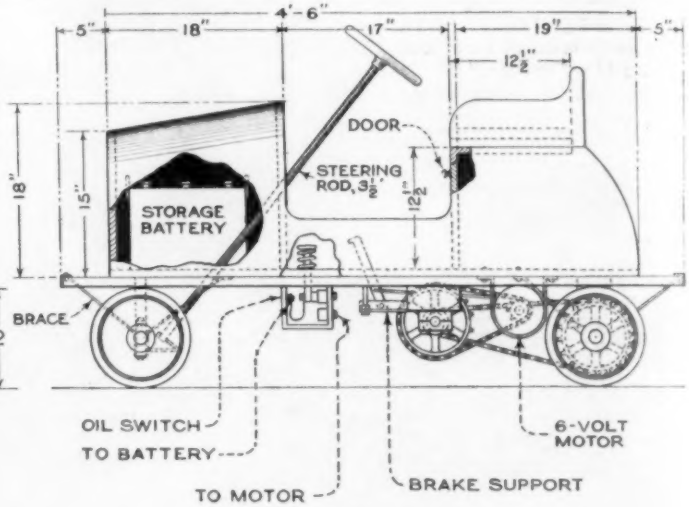
Four bicycle sprockets and two chains form the transmission used to drive the car. Two of the sprockets are about 8 in. in diameter, and two 2½ in. One small and one large sprocket are pressed on a ⅝-in. steel shaft 6 in. long. The sprockets are made to fit the shaft by using bushings, which are turned in a lathe, and screwed or riveted to the sprockets; the sprockets are then fastened to the shaft by drilling through bushings and shaft and driving in steel pins. The large sprocket on the rear axle is fastened in the same way; it is best to ream the holes with a taper reamer and drive in taper pins. A similar method of fastening is used for the rear wheels.

The steering mechanism is similar to that of the regular automobile, and a Ford steering wheel and rod are used. The drag link may be ⅜ or ½-in. steel rod, with the ends flattened and drilled for the bolts. The manner of connecting the links to the pivoted wheels, and the method of pivoting the wheels are clearly shown.

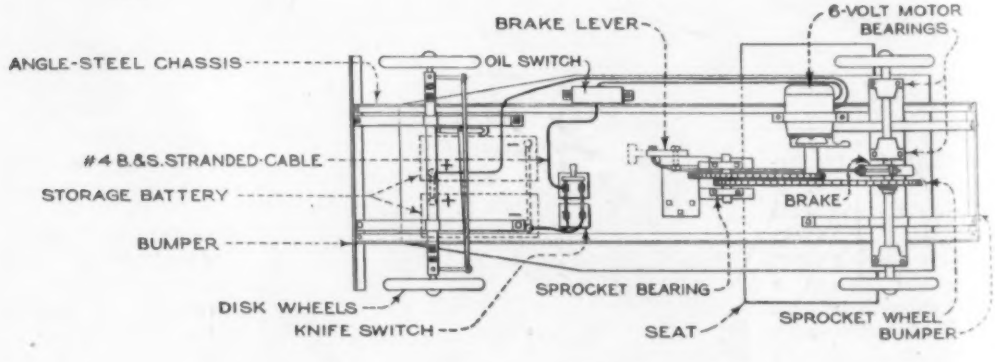
The hood of the car may be made of galvanized iron, or heavy stovepipe iron. The latter is perhaps preferable, as it holds the



FRONT ELEVATION
Fig. 1



SIDE ELEVATION
Fig. 2



BOTTOM VIEW
Fig. 3

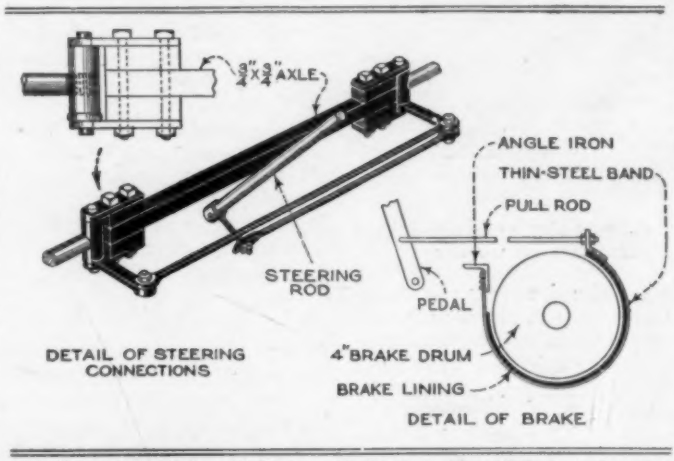
Detailed Drawings, Showing Dimensions and Location of Every Part of the Mechanism of the Small Electric Automobile; Also Wiring of Batteries, Switch, and Motor

paint better. The two 6-volt batteries that supply the current are carried under the hood; they are connected in parallel, thus increasing the capacity while keeping the voltage down to the 6 volts necessary for the motor.

The motor is a standard 6-volt automobile-starting motor, and the remaining 2½-in. sprocket is pressed on the end of the shaft and pinned. The motor is hung to the underside of the car by means of a heavy flat-steel strap.

The oil switch is made from a piece of slate ½ to ¾ in. thick, by 2 in. wide and 4 in. long; on this is mounted one dead, or "off" contact, and one that is connected to the motor. These are made of ½-in. square copper bar, 1 in. long, and are fastened to the slate panel ¼ in. apart. An iron rod, ½ in. in diameter, and 5 in. long, with a foot button on its upper end, passes through the floorboards of the car, and on the lower end of this rod is a copper contact. A compression spring is slipped on the rod between the foot button and the floorboard, to keep the rod on the off contact. When the rod is pressed down, it makes contact with the motor connection, and the car starts. Over this switch is placed a 2 by 3 by 4½-in. galvanized-iron box, with soldered seams. This is kept nearly full of transformer oil, to prevent sparking or arcking at the contacts. About 7 ft. of No. 2 starter cable is needed to wire the car, the connections being as shown in Fig. 3. A knife switch is mounted under the car, as shown, to break the circuit when the car is not in use.

The storage batteries may be recharged from any convenient 6-volt direct-current source, but a more convenient method is to mount a small rectifier under the seat of the car, and connect it permanently to the battery. A receptacle is mounted flush on the dash, and during charging hours connection is made to this plug from a 110-volt a. c. supply. A small ammeter, also mounted on the dash, should be connected in the circuit to show the current flowing to the batteries, to prevent reversal.



Details of Front Axle, and Steering Mechanism; Also Method of Mounting Brake and Its Connections to Brake Pedal

The car weighs about 150 lb. complete, and has a speed of about 10 miles per hour under full current. With two 80-amp.-hour batteries, fully charged, it will run about 5 miles. The car will climb steep grades with two or three passengers.

Saving Film Struck by Light

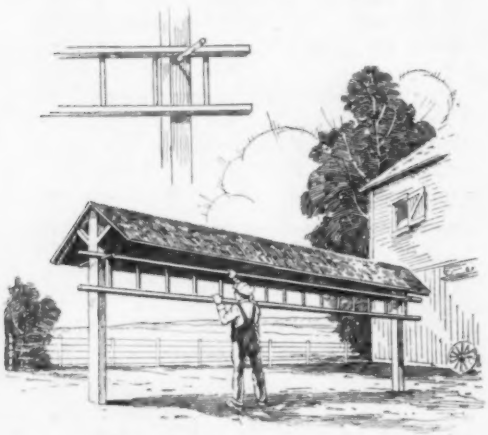
Every amateur photographer has some difficulty in always keeping his darkroom dark, as it often occurs that someone switches on a white light or opens a door just while a film is being developed. One day while developing a film that had been taken with great pains and under exceptional conditions, and could not be retaken, I turned off the red light during development to avoid any possibility of fogging, turning it on only at intervals to see how the image was coming up. In my excitement I turned on the white light by mistake instead of the red light, and exposed the film. However, injury was avoided by instantly putting the film in the hypo solution, which prevented the exposure from developing out, and snapping out the light. —Edward H. Flaharty, Denver, Colo.

Oiling Steering Column

On a Ford automobile the steering column is provided with a short bearing at the dash, but no way is provided to oil this bearing except to let oil run down from the top of the column. The result is that this bearing becomes dry and causes the shaft to squeak and drag. If a small oil hole is drilled through the column, just above this bearing, it can be oiled with an oilcan whenever necessary.

A Ladder Rack

Those who have many ladders are sometimes perplexed just where to keep them so that they will be protected from the weather, and still be easy to get at when



Easily Made Rack for Storing Ladders Where They Will Be Protected from the Weather

they are wanted. The drawing shows an ideal rack for this purpose. It is provided with a roof so that the ladders will be adequately protected from rain and snow, and as the sides and ends are open, the ladders are always accessible.

The rack consists of two 4 by 4-in. posts, 5 to 8 ft. high above the ground, supporting a small roof. Rafters of 2 by 4-in. material, laid flat, are nailed securely down on the posts as shown, and are braced with 2 by 4-in. crosspieces. The roof consists of 1-in. boards nailed on the rafters in the usual way and covered with roofing paper or shingles. A hole is drilled through each post near the top and a length of pipe driven through to serve as a ladder hook.—Robert Page Lincoln, Hopkins, Minn.

Starting a Cold Auto

Before starting the car on a cold morning raise the radiator hood and pinch the lower hose connection to feel whether or not the water is frozen. Even though one is using plenty of alcohol in the water for average winter temperature, an unexpected drop of temperature below the freezing point of the solution may cause it to freeze solidly. It is therefore better to be sure than sorry, by feeling the rubber-hose connection. Starting the motor during cold weather when the oil thickens between the pistons and cylinders is very hard on the storage battery. To prevent excessive discharge due to this cause it is a good practice to turn the crankshaft over by hand a few times, with the ignition switch turned off, in order to break up the stiff film of oil.

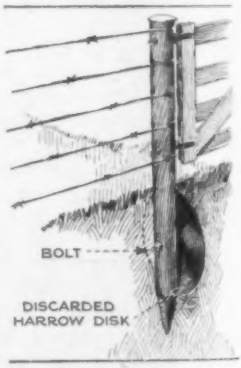
Ordinary winter temperatures will not freeze the electrolyte of the storage battery very quickly unless it is almost entirely discharged. Therefore the battery should always be kept well charged.—A. G. Zeller, Detroit, Mich.

Enamel Streak Aids Night Shooting

Poultry raisers are often bothered by nocturnal prowlers, such as skunks, weasels, possums, etc., which have the habit of robbing the hen house of the choicest fowls. A shotgun is often used to shoot them, but due to the darkness one cannot aim well, and this results in poor shooting. It has been found that a strip of white enamel, ⅛ in. wide, painted down the center line of the barrel helps considerably in sighting at night.

Bracing Fence Posts

Fence posts that must support more or less weight, as, for instance, a gate, should be securely anchored in the ground to prevent them from being pulled to one side. Large stones and bowlders are frequently used to steady the post, but in some regions there are very few suitable stones, and therefore other methods must be used. Discarded harrow disks have been found excellent for this purpose. A disk is bolted to the bottom of the post, as shown in the illustration, and the post is then driven into place with the flat side at right angles to the direction of strain. The post with the disk attached can easily be driven in, as the disk offers very little resistance, due to its sharp edge, and the end of the post is sharpened to a point. Bracing fence posts in this way has been found very efficient and can be accomplished with a minimum of time. Corner posts can be braced in the same manner by driving the post with the disk at an angle of 45° to the wires.

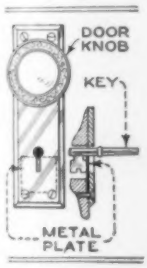


Electric Alarm for Bread Dough

An electric alarm to indicate when bread dough has risen sufficiently was installed in a bakery, and could just as well be used in the home. Nothing more is required than a pivoted lever with one end resting on the dough and the other end arranged to make contact and close a bell circuit when the dough has risen to the desired height.

Keeping Keys in Door Locks

Many door keys have a tendency to drop out of the locks frequently, which is very annoying, especially when the door is in constant use, and every slight jar causes the key to fall out. It is, however, a simple matter to prevent this trouble by inserting a small metal plate under the lockplate as indicated in the drawing. The space that this plate should occupy is shown by the dotted lines; it should be as long as the width of the lockplate and wide enough to extend from the shank of the key, when inserted in the lock, to the lower screws holding the lockplate in position. The object is to close the slot through which the key is inserted. Obviously, this device is an excellent burglar protection as the key cannot be pushed out of the lock from the other side.—J. E. Decker, Chicago, Ill.



Lubricating Wristpins

Wristpin bearings in automobile engines generally become loose mainly because the upper side is not properly lubricated. This trouble may be overcome by cutting a groove of saw-tooth form just below the lowest piston-ring groove and drilling a hole down through the upper part of each wristpin bearing as shown in the illustration. The oil scraped up by the groove will naturally drain through the holes and lubricate the top of the wristpin. The holes drilled through the piston will not cause any loss of compression.—Worth Alexander, Santa Ana, Calif.

Simple Device Stirs Milk While Cooling

Fresh milk is often stirred in order to cool it, and this is usually done by hand, which is a slow and tiresome task. A simple device for doing the work automatically by water flowing into a tank, as shown in the drawing, can be made by any farmer from materials that are available everywhere.

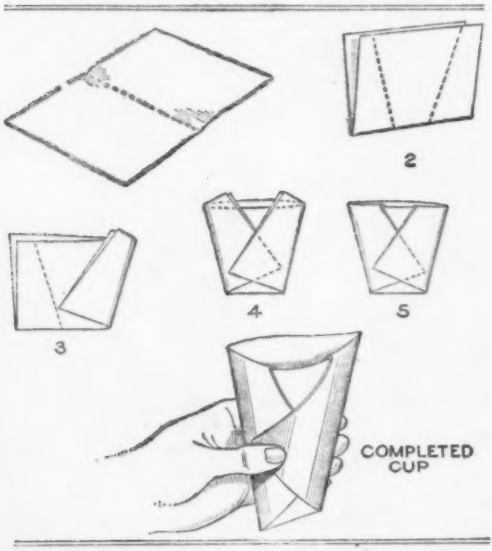
A Simple Rocking-Box for Stirring Fresh Milk Automatically by Water Flow

The device consists of a shallow box, made of 1-in. pine boards. The ends are sloping and the box is divided into two equal parts by a board extending vertically in the center about 8 or 10 in. above the sides. The box is mounted at its center on a wooden axle, and a stirring paddle is attached to each end as indicated. These paddles are made from laths, planed smooth, and having a number of short crosspieces nailed on. In use, the milk cans are placed in the water tank and the stirring device arranged as shown in the drawing, the rocking-box being located under a water pipe so that the water first flows into one side and then into the other side alternately. As soon as one side of the box is filled the weight of the water causes the box to tilt over, and the other side of the box is then filled.

¶ Kitchen knives can be sharpened by rubbing them on the edge of a stone crock. Use first a forward and downward-slanting movement, then pull back and down.

Making a Paper Drinking Cup

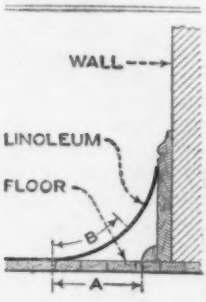
A simple method of making a paper drinking cup is shown in the illustration. The sheet of paper is regular business size; 8½ by 11 in. The piece is first folded in half as shown in Fig. 1, then diagonally as shown in Fig. 2, and the projecting corners are turned over the edge of the cup, which completes it. The strength of the cup, of course, depends on the kind of paper used.



Simple Method of Making a Drinking Cup of Paper

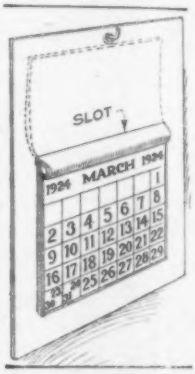
Cutting Linoleum

Large pieces of linoleum are usually cut a few inches too long so that when laid down, previous to tacking in place, one edge runs up against the wall as shown in the illustration. A strip must then be cut off this edge so that the linoleum will fit snugly in the corner, and here is just where the difficulty comes. Naturally the width of the strip to be cut off should not be guessed at. A simple and accurate method of measuring the distance is to first make a mark on the linoleum at one end where it lies flat, say about 12 in. from the edge of the wall, as shown by arrow A. The same distance is marked off on the linoleum as indicated by B and a corresponding mark made at the other end. A straightedge is then laid across the marks and the linoleum is cut off along this edge. It will now fit snugly against the edge of the wall.



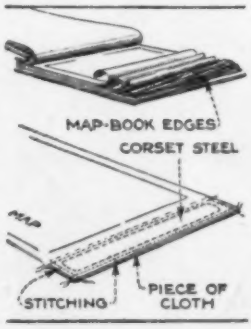
A Reference Calendar

Almost everyone has occasion at one time or another to refer to some previous month on the calendar, and this cannot be done if the leaves are torn off, unless all the months are printed under the last leaf. Simply folding the leaves up does not look neat and the leaves will not stay in that position. An excellent method of folding back the leaves is shown in the photograph. A slit is cut over the calendar pad so that the leaves of previous months can be drawn through it when they are no longer needed. These leaves will then be out of sight, but are still always ready for reference.—Edwin G. Baker, Indianapolis, Indiana.



Preventing Maps from Curling

Usually after a large map book, such as is found in the offices of city engineers, has been used for some time, the edges of the leaves become cracked, torn, and have a tendency to curl up, which makes them difficult to read. One of the simplest methods of remedying the trouble, at a minimum of expense, is shown in the accompanying drawing. A strip of cloth, doubled over, is stitched along the edge of each leaf, on the underside, thus forming a seam about ½ in. wide. A suitable length of corset or clock spring is then inserted, and the seam sewed shut to keep the spring in place. The edges of the leaves will then be kept down by the weight of the spring steel.

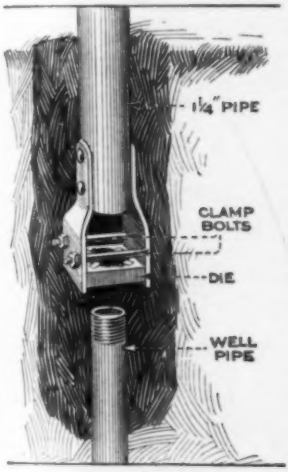


Removing Ford Rear Wheel

When it is necessary to remove the rear wheel of a Ford but no wheel puller is available the following method will prove effective: Remove the hub cap, cotter pin, and retaining nut. Inside of the hub place 3 or 4 washers with openings too small to slide over the end of the axle. Screw the hub cap in place as far as the threads allow and tap on the end when it turns tight. If the wheel is still tight repeat the operation until it is loose, adding a few more washers in the cap, but taking care not to strip the hub-cap threads.—Harold Pinkerton, Pawnee City, Neb.

Rethreading Well Pipe

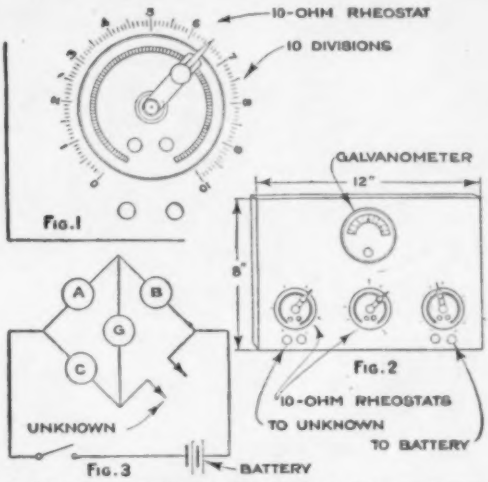
Rethreading a damaged well pipe without removing it from the well can be accomplished by the tool shown in the illustration. The tool consists of a length of 1¼-in. pipe with two pieces of flat steel riveted on one end to hold a threading die. The die is held firmly between the pieces by two bolts as shown. In use, the threading fixture is lowered into the well and the die placed on the end of the pipe to be rethreaded. A small pipe wrench is used to turn the pipe that holds the die, or a hole drilled through the top to take a short bar.



A Simple 1,000-Ohm Wheatstone Bridge

An instrument much needed by the electrical student and experimenter, and seldom obtainable at reasonable cost, is a Wheatstone bridge for measuring unknown electrical resistances in telephone receivers, motor windings, and for similar purposes.

In the construction of the instrument described, it is unnecessary to wind any resistance coils; use three of the popular 10-ohm circular rheostats that can be obtained from almost any electrical-supply store. The rheostats are calibrated, as indicated in Fig. 1, by drawing an arc around the rheostat and marking it off into 10 divisions of one ohm each, each subdivision indicating one-tenth ohm.



A Wheatstone Bridge for Finding the Unknown Resistance of the Windings of Electrical Instruments

A small hardwood panel may be used for holding the rheostats, as in Fig. 2. The galvanometer, which is a standard instrument, is connected into the circuit, as shown in Fig. 3, binding posts being provided on the panel for connection to the battery and unknown resistance.

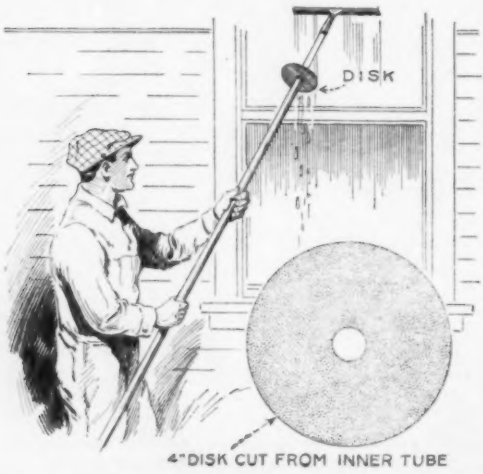
In use, connect a battery, of two or three cells, in series with a suitable switch, to the battery binding posts, the resistance to be measured being connected to the "unknown" posts. Turn on the current, and, due to the fact that the circuit is not balanced, current will flow through the galvanometer, which will register the flow one way or the other. Now, change the various resistances until the galvanometer needle shows no change when the current is turned on. The proper sequence of resistance changing is really quite complicated, but a little practice soon enables the user to get the right values quickly.—Philip A. Wall, Bedford, Massachusetts.

Keeping Tennis Balls "Lively"

Tennis balls tend to become less "lively" if kept over the winter months, due to the loss of air and the hardening of the rubber. If kept in a tightly sealed fruit jar they will retain their elasticity much longer than usual.—Charles D. Tenny, Gooding, Idaho.

Kink for Window Washers

When washing windows the surplus water has an annoying tendency to run down the handle of the cleaner and into



Disk on Handle of Window-Cleaning Squeegee Keeps Worker Dry

the sleeves or onto the clothing of the worker. This trouble may be eliminated by placing a small rubber disk on the handle, about a foot from the end, as shown in the illustration. The water will then run down only to the disk and there it will drip off.

The disk should be about 4 in. in diameter and should be cut from soft rubber, such as a piece of inner tube. A hole slightly smaller than the thickness of the handle is cut in the center of the disk so that it will fit the handle snugly when slipped into place.—Denby Clark Stephenson, Augusta, Kan.

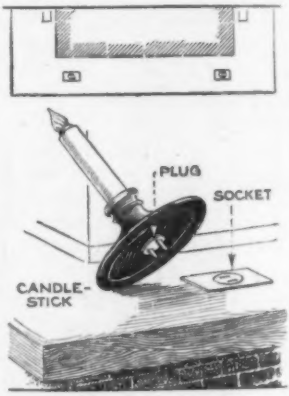
Using Radiator-Leak Compounds

Autoists who use commercial or home-made compounds for stopping small leaks in radiators often find that the cure is only temporary. This is generally due to a slimy scale that forms on the inside of the radiator after it has been used for awhile and prevents the non-leak compound from adhering. This scale must first be removed and the compound will then stick. A good method of removing the scale is to add about 10 oz. of concentrated lye to the water in the radiator, then allow the engine to run about 10 or 15 minutes with the spark retarded so that the water will be heated considerably. This solution is drained out and the radiator rinsed thoroughly, which can be done by means of an ordinary garden hose. Reversing the flow of the water in flushing also helps to dislodge some of the scale. Common washing soda added to the water in the proportion of 1 teacupful to 2 gal. of hot water, is also very effective for this purpose.

The solutions should not be made stronger than advised above as they are then liable to attack the rubber hose and the metal itself. They should under no circumstances be left in the radiator longer than an hour, and care should be taken not to spill them on painted or varnished surfaces. Lime deposits in kettles can be removed in the same way.

Wiring Mantel Candlesticks

The appearance of electrically lighted candlesticks on the mantelshelf of a fireplace is usually marred by the lamp cord that connects the candlesticks to a nearby socket or receptacle. This cord can be eliminated entirely by wiring the mantelshelf in a slightly different form than usual. This is done by providing a flush receptacle directly under the base of each candlestick and wiring the candlestick as shown in the illustration, providing it with a cap to fit the receptacle. A hole is drilled in the center of the base to receive the cap, which is first wired and pulled up into position by drawing the wires through the candlestick, and the other ends are then connected to the socket terminals.—L. H. Georger, Buffalo, New York.



Tightening Eyeglass Lens

Loose eyeglass lens can be permanently tightened by putting a little shellac in the groove by means of a pointed match or toothpick and allowing it to dry until it is partly set. The lens is then replaced in the frame; if too tight it must be warmed up until the shellac softens. Perspiration or other dampness does not loosen it.—S. A. Asquith, Los Angeles, Calif.

An Electric Insect Killer

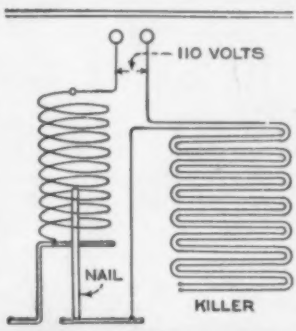
By C. FISKE

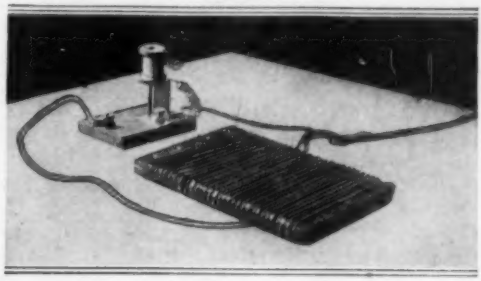
ALTHOUGH the 110-volt house-lighting current is ordinarily not fatal to the human body, it is very effective for electrocuting small animals and insects, because the resistance of these bodies is much less than that of the human body. This explains the effectiveness with which the electric insect killer, shown in the illustration, disposes of roaches, flies, spiders, and other insects. Once the apparatus is set up, it requires little or no attention, as it is automatic in its action, and there is no danger in having it connected continually.

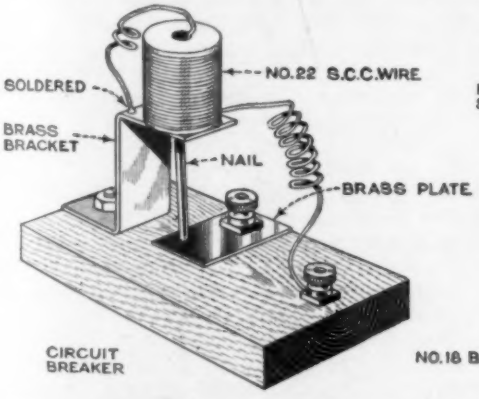
The killer consists of a 10 by 12-in. slab of slate or marble with copper wire wound on it. The edges are nicked with a file to hold the wire in place securely. Care must be taken to get the nicks about ⅛ in. apart so that the wires will run close to each other but will not actually touch. The wire used for this purpose is preferably No. 18, and it must, of course, be bare. Two separate lengths are wound side by side so that the alternate wires will be of opposite polarity when connected to the circuit. The ends of the wires are securely fastened to a pair of ¾-in. brass screws at opposite corners of the slab to prevent the wires from unwinding. The heads of these screws project far enough below the slab to prevent the wires from touching the surface of the table upon which it is laid, and single screws are provided on the other two corners so that the slab will rest solidly.

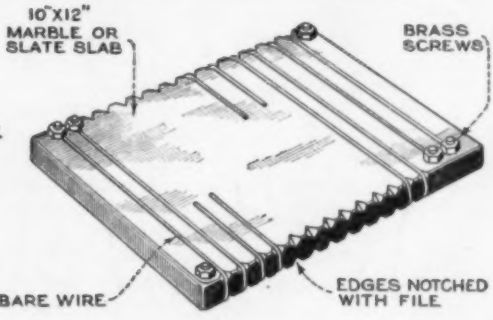
As soon as an insect crawls or alights on the wired surface of this slab, on which sugar or other attractive bait is spread as a lure, it touches two wires of opposite polarity, and this allows a sufficient amount of current to flow through its body to kill it instantly.

It is not advisable to connect the wires of the slab directly to the lighting circuit as a small piece of metal, accidentally dropped on the wires, will blow a fuse. A small circuit breaker should be provided to prevent this. The construction of a simple one is shown in the lower left-hand detail. It consists of a solenoid made by winding an ordinary thread spool full of No. 22 single cotton-covered copper wire, and using a small wire nail, with the head clipped off, as a plunger. The solenoid is mounted on a brass bracket, which is bent to the shape shown, and screwed to a wooden base. Through this bracket, directly under the hole in the spool, a hole









An Electric Insect Killer, Which Uses House-Lighting Current, and Has Been Found Very Effective. A Small Circuit Breaker Protects the Fuses in Case Too Much Current Flows

is drilled for the plunger. The spool is held on the bracket securely by small wood screws driven in from underneath. The height of the bracket should be a little less than the length of the plunger. A small brass plate is fastened to the base so that the plunger rests on it when in its normal position, and a thumbnut is provided on the screw that holds this plate in place. A second screw and thumbnut are provided as a separate terminal on the base, and to this terminal one end of the solenoid coil is connected, while the other end is soldered to the brass bracket. Connections are then made to the lighting circuit and to the killer, as shown in the diagram in the upper right-hand corner.

The action of the solenoid is as follows: Current passes through the solenoid and over the bare wires of the killer whenever any two wires of opposite polarity are brought into electrical contact with each other, either through the body of the insect or a piece of metal, shorting them. As soon as the current becomes excessive, as it would naturally be in the latter case, the plunger is pulled up into the solenoid, and this breaks the circuit. Of course, the moment that the current is broken the solenoid is demagnetized and the plunger drops again to its normal position, but if the same current still flows the process is repeated continually, causing the plunger to vibrate rapidly. In operation the killer should, therefore, be set up on a slant so that every time an insect is killed it promptly falls off, preventing any long-continued operation of the circuit breaker.

It is surprising how many insects will be killed by this death trap if it is located in the proper place and baited with some sweet-smelling substance. The device can be left connected without any danger to the house wiring. If desired, a ½-amp. fuse can be inserted in the circuit so that in case the plunger sticks, the small fuse will be blown before the one in the lighting circuit.

Novel Method of Finishing Cypress

Although there are other woods more or less susceptible to the same or similar treatment, cypress, on account of the great difference between the carbonization point of the hard spring growth and the softer summer growth, is better adapted to the method of finishing described than any other. The difference between the hardness of the spring and summer growths is essential, as a flame is used to char the wood, and, in the case of cypress, a degree of heat that will char the softer parts will merely color the harder parts, and there is no pitch or resin to interfere with the treatment.

The driest possible lumber should be selected, and it should be sawed flat, showing but little edge grain. No attention need be paid to heart, sap, blue, or other stains, as the burning obliterates all defects in color. Checked and split boards should be avoided, however, as the defects will be aggravated by the burning, and the boards should be perfectly flat.

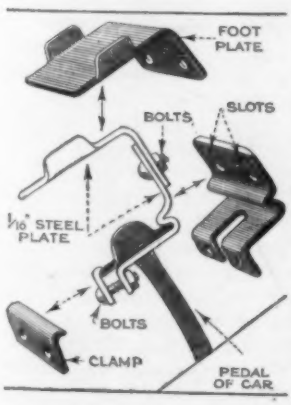
An ordinary gasoline blowtorch is used, and operated so as to get the hottest possible blue flame. This flame should be directed against the surface to be treated, and the burning should be merely sufficient to turn the surface black. Overburning should be avoided. The extreme heat of the torch will dry out the treated side and cause the board to cup toward the flame while it is being burned. Immediately after burning, the work should be set aside without further treatment for at least 48 hours, in order to allow the moisture in the wood to balance itself. The warping is an unavoidable condition, which, however, remedies itself, if the pieces are set aside after charring, and if the boards were flat at the start. The straightening of a piece after it has been burned can be hastened by laying it on the ground, burned side down, and allowing the sun to shine on the back. The same thing can be done by using an open fire or radiator, turning the unburned surface to the heat.

The next operation consists in rubbing the charred surface with an ordinary steel-wire brush. Rub out all the charred portions, either with the grain or at right angles to it, although the former is perhaps preferable. Care should be used in the rubbing, to get as even a color as possible, as it is natural that the deeper a piece is rubbed the lighter the color will be. The final color effect depends entirely upon the rubbing, and not upon the burning, as might be supposed. One or two experiments on small pieces will teach all there is to know about the process. It is essential that each piece be cleaned of the dry brown powder that will accumulate in the grain; this can best be removed with an ordinary scrubbing brush.

The scrubbing brush imparts a beautiful finish when removing the brown powder. The work can be rubbed with rags or cotton waste, but the brush is better. As the finish at this stage is particularly beautiful, and has a soft brown color that is very pleasing, the work may be considered done. However, if a gloss finish is desired, ordinary floor wax, well rubbed in and polished, will give more brilliancy and contrast. An even better way to obtain an effect of color consists in thoroughly coating each piece with lead paint of the color desired, and immediately rubbing off all the paint that can be removed by wiping with rags. This will give a very pleasing effect, with the natural grain showing in relief. Varnishes should be avoided, as they cheapen the appearance of the work, and the results are not especially pleasing. Another effect can be obtained upon cypress treated in this manner by an application of muriatic acid, after the work has been burned and brushed out, but before wax or any other finish has been applied. The effect of the acid is to remove, to a large extent, the contrast of color, and to produce a pleasing gray tone.

Pedals for Individual Drivers

In many instances different members of a family or different employes of a firm drive the same car. The varying size of the drivers often makes the pedal position unsuitable for either the short or the tall drivers. A good method of compensating for these differences without altering the pedals is to provide an attachment of the kind shown in the illustration. This attachment is merely an extension on the pedal arranged so that either the pedal or the extension can be used by the driver. It consists of two parts made of $\frac{3}{16}$-in. steel plate, bent to the shape indicated; one piece is clamped to the pedal and the other is bolted to the first, a slot in each permitting adjustment. The attachment can readily be made without resorting to forgings.



"Limousine" Sled for Small Children

Small children greatly appreciate the "limousine" sled shown in the photo, as it gives them the thrill of riding in their own sled, yet keeps them much warmer than an open one. The frame is made of smooth 1 by 2-in. wood, securely attached to the sled. The lower part of the frame, the floor of the sled, and the top are covered with heavy canvas, and panes of glass or heavy celluloid are fitted in the upper half of the frame as shown. The back serves as a door, being hinged on so that it can be opened or closed, and a screen-door hook provided to keep it closed. The door is made of 1-in. wood, covered on the outside with canvas to match the rest of the body.—Eugene Holland, Detroit, Mich.

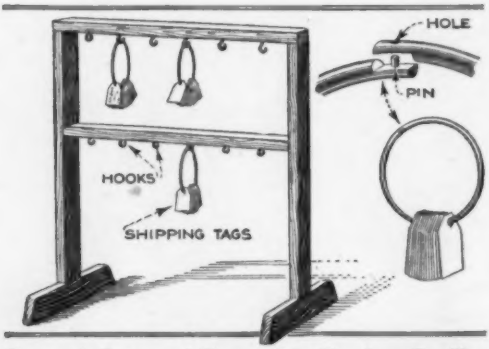
"Limousine" Which Keeps Small Children Warm While Sledding in the Snow

Preserving Fish Lines

Silk casting lines are often allowed to lie around in the tackle box on a shelf and are thus exposed to all changes of temperature and humidity. The result of such exposure is that the lines become weakened and cannot be relied upon when needed to pull in a heavy fish, as they usually break just at a critical moment. The lines should therefore be protected against effects of temperature and humidity. A good method of doing this is to wind each line on a spool and keep the spools in a tightly corked bottle. Lines have been kept in good condition in this way for 3 years. Straight olive bottles, or similar ones with the neck and body of the same diameter, are excellent to use for this purpose. The bottle is first corked and the tin cap then screwed on, with a piece of waxed paper under it.—Robert Page Lincoln, Hopkins, Minn.

Tags Aid in Distributing Newspapers

The proprietor of a news stand has adopted the idea illustrated to familiarize newsboys with their routes. The names of

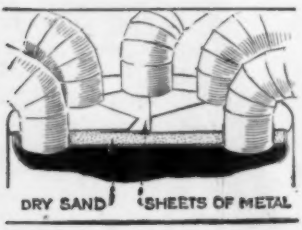


Tags with Customers' Names Make Newsboys Familiar with Routes

the customers, their addresses, and the paper to be delivered to each, is written on tags, and these are kept in the order that the customers' homes are found on each route. The tags, which are ordinary shipping tags, are strung on a steel ring about 10 in. in diameter, and are taken along by the newsboy until he becomes so familiar with the route that he does not need to refer to the tags. One ring of tags is kept for each route, and, when not in use, is hung on a small rack made for the purpose. —A. C. Cole, Chicago, Ill.

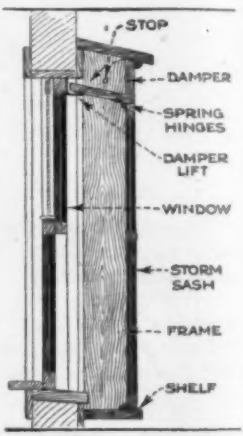
Preventing Loss of Furnace Heat

Although the installation of a hot-air furnace in homes of moderate size is considered one of the most healthful methods of heating, the loss of heat due to radiation from the furnace and hot-air ducts is an objectionable feature, and this, of course, means a proportionate waste of coal. A large area where heat is lost is the flat top of the furnace, if this is not properly covered with some nonconducting material. The top of the furnace should be covered to as great a depth as possible with coarse sand, and sheets of bright, smooth tin laid on it, holes being cut in the pieces to fit around the hot-air ducts, and the results will truly be surprising. In making tests to determine the effectiveness of this method, it was found that the temperature above the furnace top, with the thermometer not more than ¼ in. from the surface, was 95° without any covering, 75° with sand only, and 60° with sand and the tin cover. The hot-air ducts are usually covered with a single-ply asbestos paper. The object of the asbestos is, of course, to retain the heat, but thorough tests at the University of Illinois have shown that approximately 30 per cent more heat is lost from ducts so covered than from ducts having no covering whatever.



Ventilating the Kitchen

In the construction of many houses the kitchen is built without much thought or consideration for the cook. The storm windows do not usually permit much ventilation and no pipe is provided to carry away the smoke and fumes from the gas stove. A good method of providing proper ventilation is shown in the drawing. A wooden box incorporating the storm window is built around the window on the outside. This box is made about 5 in. longer than the storm window, which is allowed to rest on the lower edge of the box, thus leaving a 5-in. space at the top. A right-angled wooden damper is made to fill this space; it is hinged to the upper end of the storm sash, and long enough to rest on a length of angle iron screwed to the upper edge of the inside sash. Opening or closing the inside sash automatically opens or closes the damper. Whether the damper is open or closed the space between the two windows is practically tight all the time. The box itself can be used as an iceless refrigerator during the cold months, small shelves being built on the sides so as not to shut off any light, if the box is made wide enough for this purpose.—M. E. Duggan, Kenosha, Wis.



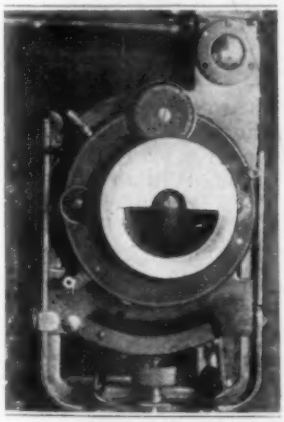
¶Leaky automobile tops can be permanently repaired by using ordinary inner-tube patches to cover the openings.

A Soldering Kink

It frequently happens that solder cannot be made to cover a large hole in a utensil. This difficulty can be prevented by holding a piece of cloth, folded to make a thick wad, under the hole, and unless the hole is entirely too large the solder can then be made to cover it. A very large hole can be closed by reaming it out, cutting a disk of tin to fit, and soldering this disk over the hole. The surface to be soldered should always be perfectly clean, and it is a good idea to use a file on it to roughen it slightly. Plenty of flux should be used to make the solder unite the parts firmly. —Louis Schneider, Clinton, Mo.

An Efficient Sky Filter

Most sky filters used in photography accomplish their purpose by using colored glass or celluloid over the lens, which screens out the blue and violet rays, rendering the sky a grayish shade instead of white as when no filter is used. When photographing buildings it often happens that halation makes the top of the building very light or over-exposed due to the brightness of the sky. This trouble is especially noticeable when photographing against the light, making the use of a sky filter necessary. A new kind of filter, shown in the photograph, permits an even exposure of the entire building and allows just enough exposure for the sky to make it come out white instead of gray. It can readily be made in a few moments from an empty paper pill box. The pill box should fit over the lens as snugly as possible. Two semicircular holes, one large and the other small, but both concentric, are cut in the bottom as indicated. The covered portion of the lens shuts out the excessive sky light, while the small semicircular hole allows just enough sky light through the center of the lens to expose the sky properly without any halation.—E. H. Flaharty, Denver, Colo.



Lightening Canoe Paddles

A canoe enthusiast who desired to make his paddles lighter without sacrificing strength, grooved the handles on each side, the grooves being cut in line with the edges of the blades. To make the handles perfectly round at the point where they are gripped when paddling, short pieces of wood were glued in the grooves, and trimmed down to the original contour of the handle. A few ounces saved in this way does not seem much, but on an all-day grind when the paddles are held constantly and swung thousands of times, a little less weight counts considerably.—Leroy William Hutchins, Bronxville, N. Y.

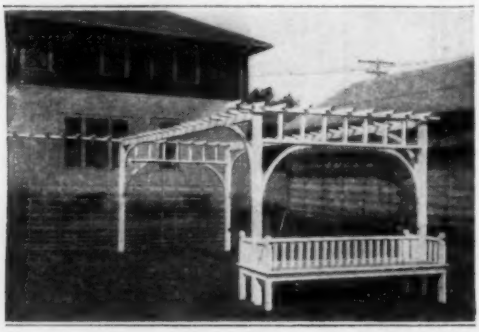
Grooving the Handles of Canoe Paddles Reduces Their Weight without Sacrificing Any Strength

Getting Rid of Rodents

All food that is stored in the cellar or pantry should be kept in metal or glass containers if possible, as this will keep it out of reach of rats and mice. Large quantities of potatoes and other vegetables should be kept in wooden bins, lined with tin or galvanized sheet iron. If food is stored away from rodents they will not remain long but will go where more hospitality is extended. This method has been found much more effective than the usual methods of destroying and trapping the rats and mice.—Mable Chase Rundlett, North Adams, Mass.

An Ornamental Laundry Yard

By making the laundry "yard" ornamental as well as useful the appearance of the backyard and garden can be improved considerably. A neat way of building the laundry yard with a lawn seat integral with it, is shown in the photograph. The



Laundry Yard that Adds Beauty to Usefulness by Incorporating Trellis-Work and a Lawn Seat

yard is about 20 ft. long and 10 ft. wide. The posts are made of 4 by 4-in. material, are set in the ground about 2 ft., and extend about 8 or 10 ft. above it. Lengths of 2 by 4-in. stock connect the top of all four posts, the two 20-ft. lengths being laid with the narrow side up, and the 10-ft. lengths laid flat, resting on the caps of the posts. A narrow fence effect on the ends at the top is produced by nailing a 10-ft. crosspiece of 2 by 2-in. material about 18 in. below the top crosspiece, and nailing 18-in. lengths of 2 by 2-in. wood vertically between the two crosspieces. The curved braces are simply lengths of 1 by 2-in. wood, steamed and bent, and nailed in the positions indicated. The top of the structure is given an ornamental touch by adding trellis-work of 2 by 2-in. material with the ends cut off at an angle as shown. A double seat, back to back, extending between two end posts, affords a good rest for the laundry basket. The seat is made of 1-in. boards nailed to a 2 by 4-in. frame. The back consists of short lengths of 2 by 2-in. material, with a 2 by 2-in. stringer laid across the top and nailed on. The legs extend to the top of the arm rest, where they are notched and rounded to add to the ornamental effect. When completed, the whole is given two or three coats of white paint, which will set it off distinctively.

¶Windows to which one or more coats of waterproof varnish has been applied permit the light to enter, but cannot be seen through.

Removing Putty from Window Frames

Removing the pieces of a broken window pane is comparatively easy, but the putty along the edges is usually very hard and nearly impossible to remove without splintering the wood of the sash. However, it has been found that the putty will come off easily if softened with an application of hot lye, applied with an old paint brush. After allowing it to soak for half an hour, the putty peels off without any trouble, permitting a neat and clean job of reglazing to be done.—L. H. Georger, Buffalo, N. Y.

Curing Leaky Faucets

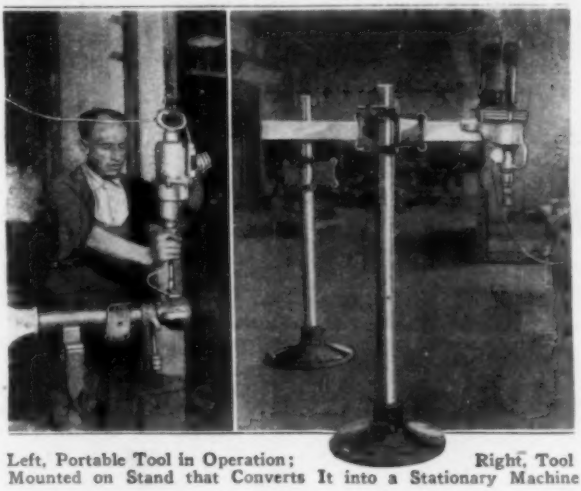
The rubber-ball valves in water faucets sometimes become so hardened that water is allowed to leak out continually, which is very annoying and, of course, also wasteful. A good method of repairing such a valve, when a new one is not available, is to remove it from the faucet and immerse it in a pan of gasoline for about an hour. This bath will soften the rubber considerably, and the valve can then be replaced in the faucet, when it will give good service for months.—G. E. Hendrickson, Argyle, Wis.

Filling Storage Batteries

Filling the cells of storage batteries with distilled water without spilling can be accomplished conveniently by the use of a small filling bucket of the kind shown in the illustration. The bucket is made from a hard-rubber jar of large size with a wooden handle attached to the top and a small hole drilled through the side near the bottom. A hard-rubber nipple is securely fastened in the hole with sealing compound, and a length of rubber tubing attached. Not a piece of metal is used in constructing this bucket so that there will be no danger of rust getting into the electrolyte of the storage batteries. The free end of the rubber tubing is placed inside of the jar, as shown, to prevent the water from running out when the bucket is not in use. The bucket can easily be handled, can be set on any flat surface and can be used without a syringe or funnel.

ELECTRIC DRILL IS STUD AND SCREWDRIVER

Designed not only to serve for the rapid starting and driving of nuts, studs, and screws, a new electric tool is also used on drilling and reaming operations. It is a real high-production tool. Wrenches, screwdriver, stud driver, or drill chuck can be changed instantly for the different operations.



Left, Portable Tool in Operation; Right, Tool Mounted on Stand that Converts It into a Stationary Machine

The tool is built under a patent covering the operation of a friction clutch used in combination with a positive clutch, where the engagement or disengagement is caused by an axial movement in either direction. It thus permits a ready engagement of the driving member with the part to be driven, and, after the seating of the driven member, allows an instant disengagement while the motor is running.

The motor is a universal one, specially designed, and the clutch is made so as to prevent any shocks from reaching the motor. The chuck is also a special one permitting the wrenches, drivers, or drill chucks to be changed at will, while the motor is at full speed.

A stand is furnished that makes the tool a stationary one, operating in a similar manner to a radial drill.

STEEL BALLS COMPENSATE FOR GAUGE WEAR

Made in a large variety of sizes, 1 in. and over, a new gauge for internal diameters is particularly useful for rapid inspection.

The stem of the gauge is cupped at both ends to hold a 5/16-in. steel ball, held in place by a threaded sleeve. The actual measuring contacts are thus furnished by the steel balls, and compensation for wear may be attained by loosening the sleeves and turning the balls slightly to expose unused portions of their surfaces. In this way the accurate length of the tool may be retained for an indefinite period.

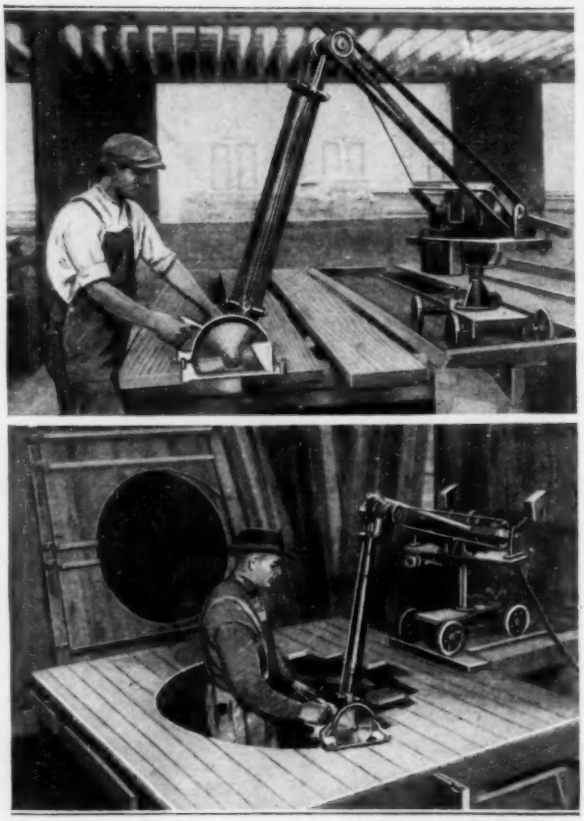
The Length of this Gauge Is Kept Accurate by Means of Steel Balls

TIME-STUDY BOARD AIDS PRODUCTION

Time studies are conceded by all progressive manufacturers to be important factors in production, but not a great deal of attention has been paid to the equipment used for the work. This has been remedied by the marketing of a very useful time-study board and watch holder. The board provides a convenient writing surface for holding the record blanks, and holds the stop watch in a position in which it can easily be operated with the left hand while holding the board, leaving the right hand free for recording the figures. The board has also a filing recess or pocket in which all data relating to the job can be kept together.

WOODWORKING MACHINE AIDS IN MAKING FORMS

Making of forms for concrete and similar work is greatly simplified by the use of a machine now in course of production. The machine is a portable saw, and, by means of adjustable squares, on which the saw travels, the operator can cut the forms to exact length, with either square or beveled edges, in less time than it formerly took him to scribe a line to follow with the hand saw. By the use of a concaved saw and a radius rod, the machine will also cut perfect circles for column caps, etc.



Above, Cutting Off Stock, with Machine on Special Runway; Below, Cutting Circular Holes in Concrete Forms

The machine is made in four sizes: The smallest will cut off 2-in. stock; the next size 4-in. material; the third 8-in., and the largest 10-in. stuff. The saving that can be realized by the use of a machine of this type, which can be taken to the job, instead of hauling the material to the machine, is apparent. It is useful not only to concrete contractors, but to woodworkers in every line of business. The smaller sizes should be particularly useful to building contractors for cutting off trim and other operations.

HACKSAW BLADES SHARPENED BY SPECIAL MACHINE

Hacksaw blades of unusual design, a special sharpening machine for the blades, and a metal-sawing machine adapted to run at high speed under severe conditions, are features of new equipment recently placed on the market. The blades are made of high-speed steel, hardened throughout, and can be resharpened many times, even when the original teeth have been completely ground away, as a set of teeth of patented form extends below their root. It is said that the blades cut progressively faster after each sharpening, and are especially suited to hard materials, including high-speed steel.

The special sharpening machine grinds the blades to models or templates which have the correct tooth shape; these are located on each side of the grinding wheel, and, as the blade is fed in, its teeth are ground to the correct shape, on both faces.

The sawing machine is built in two sizes, one for stock up to 6-in. round or square, the other for 10-in. round, or sections up to 12 by 8 in. The machines may be run at 170 r.p.m., with a heavy blade pressure. The saw holder is fitted with an indicator to show when the blade has been strained sufficiently to prevent breakage, and the dash pot is provided with a device that enables a start to be made on a sharp corner of the work without danger of breaking the saw teeth, a very useful feature.

TEST BENZOL AS ENGINE FUEL

According to tests conducted by the department of the interior, at the Pittsburgh Experiment Station of the Bureau of Mines, motor benzol may serve as a satisfactory substitute for gasoline in the operation of internal-combustion engines, if refined by the use of gelatinous silica or sulphuric acid.

GLYCERIN AND WATER NEW QUENCHING MEDIUM ...

Efforts were recently made, during the bureau of standards' investigation of steels for the manufacture of precision gauges, to find a quenching medium intermediate between water and oil, and quenching curves were taken of specimens cooled in solutions of glycerin in water. These seem to fill the gap effectively, so far as the cooling rates at high temperatures are concerned. On the other hand, the solutions cool much faster at lower temperatures than quenching oil, which is a desirable property. As a commercial quenching medium, glycerin or solutions of glycerin would not be unduly expensive, for, while the initial cost is high, the glycerin does not decompose upon heating as oils do. The composition of solutions may easily be maintained by hydrometer tests; they do not give off irritating fumes like the concentrated sulphuric acid sometimes used for this purpose, and thus are harmless to workers.

FIXTURE TESTS CRANKSHAFTS

Very few automotive mechanics give the crankshaft the attention it requires in an overhaul job. This is generally due, however, to lack of facilities for testing such work. A new machine, which is very simple to use and should

Testing Crankpin with Crankshaft and Piston-Testing Machine

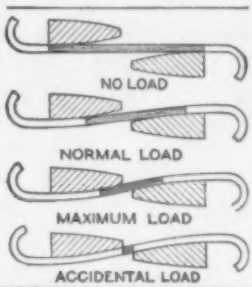
prove of value to all service stations and repair shops, is specially adapted to such work.

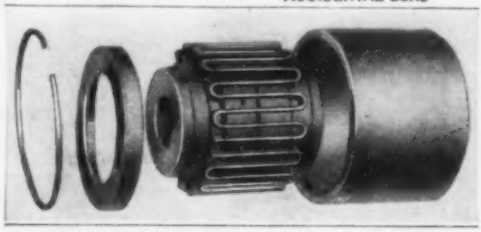
The shaft revolves on accurately ground rollers, making centers unnecessary, and the indicator shows immediately if the shaft is bent, the bearings out of round, or the crankpins out of parallel with the main bearings. For the last test, an attachment is supplied that shows graphically what pins are out of parallel, and how much.

Pistons and camshafts may also be tested on this fixture.

FLEXIBLE COUPLING ADAPTS ITSELF TO LOAD

That it will permit smooth running under exceptionally bad alinement conditions is the claim advanced for a new flexible coupling of ingenious design. The coupling consists of two flanged steel disks, one keyed to each shaft, two or more segments of a tempered-steel spring, forming a continuous grid,





Flexible Coupling that Automatically Adapts Itself to All Loads: Above, Diagram Illustrating Operation

and a shell or cover. On the outside of the flanges are cut specially shaped grooves, in which the spring is placed. The spring is the flexible member, and its shape, together with that of the grooves, forms the characteristic feature of the coupling.

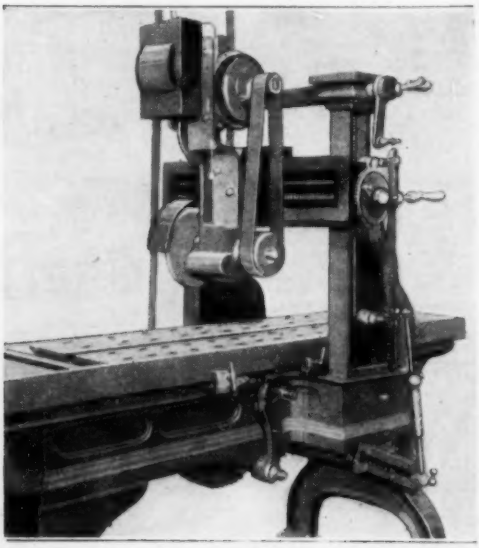
Under light and normal loads there is a long, free span of spring between the points of support on the flanges, allowing considerable flexibility, but under heavy overloads the springs are supported along the sides of the grooves, thereby automatically shortening without increasing the stress. Under very heavy overloads, the springs are in shear, and capable of resisting many times the load for which the coupling is designed.

At a recent demonstration, a centrifugal pump, mounted on a tank, was driven through one of the couplings by a 5-hp. motor. The motor was mounted so that it could be swung sidewise until the centerline of the motor shaft was 10° out of alinement with the pump shaft. When this was done, the set still ran smoothly and quietly, in spite of the tremendous misalinement.

On page 325 of our February issue, in the article on the vernier caliper, the readings should be 1-128 in. and 1/10 mm.

ATTACHMENT MAKES SURFACE GRINDER OF PLANER

Small shops will find a planer attachment now on the market a great convenience, as, with it, the planer may be



Attachment that Converts the Planer into an Efficient Surface Grinder

used as a surface grinder. The grinder attachment is fastened to the tool-head swivel, and is fed in the same manner as the regular head; the attachment is equipped with roller bearings, mounted in a dust-proof housing, and has an efficient oiling system, with a reservoir that need only be filled once a month. The motor may be adjusted to take up belt stretch. Emery wheels up to 12-in. diameter and 1½ in. wide may be used on the head.

PLASTIC METALLIC PACKING FITS ANY BOX

All users of stuffing-box packing, whether engineers, garage men, or automobile owners, will appreciate a packing recently developed. It is a semi-metallic composition, in a paste or putty-like form, which can easily be placed in a stuffing box of any size or shape, and, when the gland is set up firmly, makes a perfect fit on the shaft or rod. The material in the packing does not lose its life with long service, or become hard and brittle, but remains plastic and can be tightened with the gland at any time. It is well adapted for service on automobile water pumps and, it forms a practically frictionless metallic bearing that will not score the spindle, but forms a fine surface in service. It will seal pumps perfectly tight even when the shafts have become scored and worn. It is not affected by heat under 550° F., and is suitable for steam, air, brine or chemicals, and water.

ALUMINUM 'BUS WHEELS TESTED IN ENGLAND

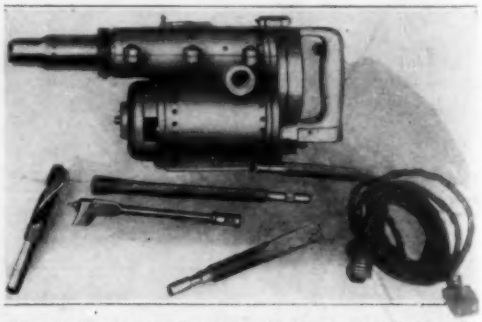
Aluminum-alloy road wheels, which, although only half the weight of standard steel wheels, have given exceptionally satisfactory results, have been tested recently by a large English omnibus company.

A number of the wheels have been running for over 30,000 miles, and tests are being carried out on over 20 routes. The economical advantage possessed by the aluminum wheel is that the scrap value is very high—about two-thirds its original casting value. A further great advantage is the large reduction in unsprung weight, and in the minimizing of road destruction.

COMBINED HAMMER AND DRILL

Apparently an ordinary electric drill, a tool recently invented by a Nebraska man, becomes a hammer merely by sliding a button. The blows are struck through the medium of a coil spring which is alternately compressed and released by a ratchet mechanism. The housing for the motor and gear train is aluminum, thus reducing weight to a minimum.

After eighteen months of semi-constant



Electric Tool that Combines Hammer and Drill, with a Few of the Tools Used

service, it is said that the ratchets show but little sign of wear, and these are the only parts subject to heavy service.

¶Oxygen tanks should never be handled on the same platform with oil or grease, which might find their way into valves.

Prize Offers and Announcements

FIFTY-THOUSAND-DOLLAR ESSAY PRIZE FOR INTERNATIONAL PEACE

To stimulate interest in international peace among persons abroad, a $50,000 essay contest, similar to the one recently conducted by Edward W. Bok, has been opened to English, French and Italian writers. The donor of the money is Edward A. Filene of Boston, Mass. The best practical plan for the general maintenance of peace is sought as the object of the contest. Any topic relative to the problem may be discussed; the League of Nations, reparations or any plan for international co-operation. Committees which will have charge of the essays submitted by writers in each of the three countries will select winning articles for the final choice.

ONE THOUSAND DOLLARS FOR ESSAYS ON ECONOMIC SUBJECTS

Two prizes, one $650 and the other $400, are offered through the American Economic Association by Roger W. Babson, to graduate or undergraduate students in any American or Canadian university or college, for the best essays on the subject, "Forecasting the Price of Wheat, of Cotton, or of Lumber." Any one of the commodities may be chosen for the discussion, and manuscripts are limited to 12,000 words. They must be sent to Ray B. Westerfield, secretary of the American Economic Association, Yale Station, New Haven, Conn., on or before Oct. 1, 1924.

FIVE THOUSAND DOLLARS IS OFFERED FOR BEST BATTERY LOCOMOTIVE

Charles Markham, of Chesterfield, England, has offered a prize of $5,000 for the best electric storage-battery locomotive for use in underground coal mines. The competition will be supervised by the mines department of the British government and is open to manufacturers, or designers who have arranged for the manufacture of their designs. Competitors may be of any nationality. The donation of so attractive a prize, it is hoped, will stimulate the development and improvement of such important mining equipment. Coal mining and metal mining have many common needs, and it is thought that improvements in equipment that result from this prize will benefit the latter industry to a measurable extent.

TWENTY-FIVE-THOUSAND-DOLLAR AWARD FOR BEST PEACE PLAN

From an anonymous bequest of $25,000, the World Federation of Education Association offers a prize of $12,500 for the best plan for international peace accepted, and its author will receive an additional $12,500 when his plan is inaugurated, according to announcements of the organization. Manuscripts should not exceed 2,500 words in length. They should be sent in a plain envelope and accompanied with one containing the author's name and address. Articles must be submitted before July 1, 1924, to Dr. Augustus O. Thomas, President, The World Federation of Education Associations, Augusta, Maine.

RADIO PRIZE OF TWENTY-FIVE DOLLARS WILL BE PAID EVERY MONTH

For short essays on Americanism that can be read over the radio in not more than twenty minutes, Station WLW offers a monthly prize of $25. Manuscripts should be typewritten and accompanied by return postage. All rights for the winning "radario" will belong to the company. Contest closes the first of each month. Address articles to Radario Department, Crossley Manufacturing Company, Cincinnati, Ohio.

THREE PRIZES FOR PEACE ESSAYS OPEN TO TEACHERS AND STUDENTS

For the best essays on "Methods of Promoting World Friendship Through Education" and on "The Organization of the World for the Prevention of War," prizes of $75, $50 and $25 will be given in a contest conducted by the American School Citizenship League. The first subject is for students in normal schools and in teachers' colleges and to the second, seniors in secondary schools throughout the country are eligible. The awards, known as the Seabury prizes, will be made soon after June 1, 1924, when the contest closes. Essays should be submitted to Mrs. Fannie Fern Andrews, secretary, 405 Marlborough street, Boston 17, Massachusetts.

ONE THOUSAND DOLLARS PAID FOR STORY OR SCENARIO ABOUT JAILS

For the best play, motion-picture scenario or short story adaptable into a play or scenario on the American jail as a contributing force to the creation of criminals and to fostering crime, the Cosmopolis Press of New York will pay $1,000. The first "next best" manuscript submitted will be sold if possible and the proceeds given to the author. The contest closes October 1, 1924. Matter should be sent to The Contest Department, Cosmopolis Press, 257 West 71st street, New York.

WRITERS TO WIN TWO THOUSAND DOLLARS IN ANNUAL ESSAY COMPETITION

Four prizes totaling $2,000 for the best essays on economic subjects are offered by Hart, Schaffner & Marx, of Chicago in a contest closing June 1, 1924. Participants in the competition are divided into two classes, residents of the United States or Canada without restriction, to be known as Class A, and undergraduates of any American college to form Class B. In the first group, $1,000 and $500 are the prizes. Awards of $300 and $200 are open in the second. Among the subjects to be discussed are "A Survey of the World's Cotton Situation," "The Theory and Practice of Ship Subsidies," "The Sales Tax," "The Theory and Practice of Unemployment Insurance," "What Conditions Limit the Amount of Wages that Can Be Paid?" "A Comparison of Business Cycles in the United States, Great Britain and Canada." Papers should be sent to J. Laurence Laughlin, Esq., University of Chicago, Chicago, Illinois.

IMPROVEMENTS IN TEXTILE INDUSTRY ARE SOUGHT BY PRIZE OFFER

Believing that discussion of manufacturing processes in the various branches of the textile industry will materially assist in more economical and efficient production, the American Wool and Cotton Reporter, 530 Atlantic ave., Boston, Mass., has offered a total of $2,000 in awards ranging from $100 to $5. There are 216 prizes in all. Arrangement of machinery, methods of routing material, suggestions for improving processes, defects that may have been discovered in present methods of accomplishing a given result and the suggestion for overcoming such defects or any other thoughts that may occur to the writer which he thinks would be of interest to someone else, are sought.

CONTESTS PREVIOUSLY ANNOUNCED

Advertising Prizes Offered: Awards amounting to $8,500 and a gold medal for best individual advertisements and campaigns in advertising; announced March issue, 1924.

American Chemical Society Contest: Scholarships and $10,000 in prizes for essays written by students in high and secondary schools to stimulate interest in chemical sciences; announced January issue, 1924.

Best Adventure Story for Novel: A $2,000 prize for an adventure story not less than 60,000 words long, suitable for publication as a novel; announced March issue, 1924.

Two Hundred Dollars for Prize Joke: Monthly first prize of $200 and smaller sums for other jokes in Gloom, a Los Angeles, Calif., publication; announced January issue, 1924.

Thrilling Experiences Paid For: Short narratives on personal "thrillers" receive prizes each month from Ace High Magazine; announced March issue, 1924.

Prize Poetry Award: Best sonnet about cities will win $75; announced March issue, 1924.

FROM THE EDITOR'S MAIL BAG

In the past I have built several of the machines that you published instructions covering construction details of in Shop Notes Department. And I will say that the plans and instructions were very easily understood and carried out, and machines are very satisfactory. I have built the following articles: an external grinder; small power-driven bandsaw; riveting machine (described just a month ago); and I have the patterns now made for the castings for the Power Scroll Saw that was described last year. The mechanic that I showed the drawings to for this machine says that it is the slickest saw that has ever come to his notice.

I believe that you are the greatest help to the mechanic that there is today, as one gets more real help from Shop Notes for least money than from any source that I know. And your great willingness to serve through the Information Bureau is one of our greatest boons.—F. W. Schwartz, Aurora, Ind.

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It is with pleasure that we respond to your request relative to the making of anything described in the pages of your fine magazine by any of your readers. My thanks are certainly due your publication for the many helpful suggestions which have been of much assistance to me in my work as general-all-around-mechanic associated with a summer-resort hotel, where the services of a plumber, carpenter, builder, designer, painter, etc., are in constant demand. In this multiple role, I have erected several rustic summer houses on the grounds whose designs were taken from Popular Mechanics. They have been much admired. A lovely Japanese pavilion graces the recreation dock built out into the lake at this place—a further suggestion from the same source. Also, a swimming pool made up of more than one description appearing in the pages of your popular magazine. We have an ornamental pergola entrance to the estate surrounding the Inn that is said to be one of the most "showy" between this place and New York City, and whose creation is largely due to designs appearing in former issues of Popular Mechanics.

Japanese Pavilion on Recreation Dock Made by Mr. Rockwell from Popular Mechanics Designs

There is scarcely a work of any degree of importance on the place now that I do not consult some copy of the magazine for hints and kinks. At this writing I am planning some rustic swings, furniture and ornamental arbors from designs which you have furnished.—H. Clay Rockwell, Ulster Park, N. Y.

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I enclose herewith a list of things I have built from descriptions published in the magazine since June, 1922. I am pleased to say that I have had full success with all of them, everything being described and explained so clearly that one cannot make a mistake. Short-wave receiver; 2-step amplifier for above (June and July, 1922); simple receiver (Nov. 1922); dry-cell tube set with 2-step amplifier (June, 1923); storage B-battery (April, 1923); and spider-coil receiver with amplifier (March, 923).—F. Thomas, Ste. Anne de Chenes, Man., Canada.

I have successfully built the jack described in the September issue, 1923, on page 467. In fact, I made a pair the same size. I find these very useful around the house for a great number of purposes. I am more than pleased to have found in your magazine what I have been wanting for a long time.—Frank Biondo, 257 La Grave Ave., S. E., Grand Rapids, Mich.

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I made the "Walking Wampus" as described in your January issue. It was necessary to make one change, namely: I inserted a phonograph needle in the nose, so that it stuck out one-sixteenth inch, in order to keep it from sliding down the board, instead of walking down. Your articles are enjoyed very much.—F. C. Hartmann, 3212 Lyndale Ave., Minneapolis, Minn.

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I wish to say that I have made the crystal receiver shown on page 157 of the January issue of Popular Mechanics. I have heard as far as KDKA at Pittsburgh, this station coming in very clearly. I consider this an exceptionally good crystal receiver.—Elvin Nelson, 107 So. Webster, Greenville, Mich.

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It is an everyday occurrence for me to make something from your magazine. Besides making things I get such enthusiasm and inspiration from your book that whenever a problem presents itself I always ask myself, "Now, how would Popular Mechanics do that?" then I go ahead and do it—funnels from bottles; bands for pipe covering; strap and stick for opening fruit jars; tire tape as repair for hose; poultry feeder; birdhouse; garden tools; filing systems; pipe repairs; valve repairs; grinding compound; leather treatment that enables me to wear shoes from one to two years; rubber repairs; bicycle attachments; painting; staining; varnishing; medicine chest; grinder from sewing machine; water syphon—in fact, so many different things that I cannot mention them all. These are just a few to show you how useful your magazine really is, and I hope you continue the good work.—J. P. Linden, Aurora, Ill.

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I feel sorry sometimes, and sometimes I am glad, that I left my whole collection of your wonderful magazines to the "Engineers of Architecture Club" in Warsaw, Poland. Many of the members studied English just for the purpose of understanding the articles in Popular Mechanics. It is used now as a reference library.—E. M. Phillippe, 47 Yorkston St., Schenectady, New York.

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As an amateur mechanic I have made and used many of the articles described in your magazine. My latest creation is a tool cabinet, and I am now working on a flat-top desk.—J. H. Shrieves, Leemont, Va.

IN accordance with the editorial policy of this magazine never to accept compensation in any form for what appears in our reading pages, and also to avoid all appearance of doing so, we are obliged to omit the name of the maker or the seller of any article described. This information, however, is kept on file and will be furnished free, by addressing Bureau of Information, Popular Mechanics Magazine, Chicago. [Editor.]